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THE REPRODUCTION AND THE SPAWNING GROUND OF THE LIZARD FISH, SAURIDA TUMBIL (BLOCH) OF TAIWAN STRAIT.

By

LIU FAH-HSUEN B. Sc. Ph. D.

and

TUNG I-HSIU

Lizard fish is one of the important fishes of the trawl catch of Taiwan. The annual catch of this fish of the bull trawlers during years 1945 to 1956 is shown in table 1, where it is clearly seen that its production is greatly increasing in the recent years.

The name lizard fish is used locally to mean fishes of two different genera and of four species. They are Saurida tumbil (Bloch), Saurida undosquamis (Richardson), Saurida elongata (T. and S.) and Trachinocephalus myops (Schneider), (Plate 1, figs. 1–4). Saurida tumbil is the most abundant species which distributes in a wider region of the sea and can be caught in all seasons of a year. S. undosquamis is also produced in rather large quantities but its distribution is limited to the South of Taiwan, in the sea south of Taiwan Bank, south of latitude 23°N. It is caught only during months from February to May. S. elongata is very rare and is found in the coastal region of the Sea, north of Taiwan. There is only a few specimen found in the sample of this

第一表 歷年手操網之狗母漁獲量

Table 1. Annual Production of Lizard Fishes in Bull Trawling.

年次 Year	總漁獲量 Total Production	狗母漁獲量 Production of Lizard Fish	漁獲量百分比 Percentage in Total Production
	kg	kg	%
1945	68,307	...	...
1946	1,969,700	23,217	1.18
1947	2,601,932	88,985	3.42
1948	3,483,000	623,320	17.90
1949	3,316,670	111,542	3.36
1950	7,686,862	170,721	2.22
1951	9,258,690	297,052	3.21
1952	10,568,525	659,869	6.24
1953	14,557,375	1,148,592	7.89
1954	17,353,969	1,929,231	11.12
1955	23,772,371	8,043,881	33.84
1956	29,976,371	8,122,109	27.10

investigation. T. myops is a fish of different genus but it is also included in local statistics. It is also very rare and appears only a short time in winter. The species investigated in this investigation is limited to S. tumbil.

Much work has been done on this fish by the Japanese. The works of Kasahara (5) and that of the Seikai Regional Fisheries Research Laboratory are the ones important to notify. Among the works of the latter, R. Okada and K. Kyushin have to be mentioned for the contribution on the biology of this fish (6). It is found that the spawing ground of this fish has not exactly been found by them. Since mature fishes have been caught by the bull trawlers of Taiwan in the Taiwan strait, it is worth while to know whether the spawning ground of this fish is in the strait of Taiwan.

MATERIAL AND METHODS

The catch records are taken from log books of bull trawlers (their operation is rather concentrated in strait of Taiwan especially during years after 1950) of the Taiwan Fisheries Company and from the Taiwan Fisheries year Book. The specimens for biological studies are collected from bull trawlers, mostly of the Gee-yeu Fishery company at Keelung Fish Market each month during 1955–56 and examined in the laboratory at Keelung.

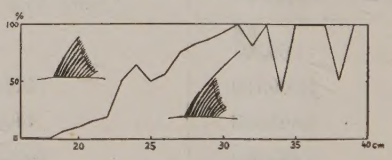
OBSERVATION

1. Sexual dimorphism.

The lizard fish possess sexual dimorphism. The males are used to have a prolongation of the second soft ray of the dorsal fin while the females have not. However, not all the males possess such a character. The appearing of such character in the male seems to bear relations with the size, and the maturity of fish and the percentage of the fish with this character varies in diffenent month of a year. Figure 1 shows

第一圖 體長別次級性徵之出現率

Fig. 1 Appearing Rate of Secondary Sexual Characteristics by Standard Length(♂).



體長 S. L.

the appearing rate of this character in relation with the standard length of the fish. It is seen that the small fish have rather a small percentage which possesses this character and the larger the fish the greater the percentage. The percentage reaches to 100% in males of 30cm long but fluctuation appears in males longer than this. Table 2 shows the monthly changes of this character. It is found that larger percentage of males which possesses this character appearing in April to June and also in October. 100% of the males of 211mm long and up possesses such character in these

months. This means that the appearing of this character bears relation to the matur ity of the male because these months compose the spawing season of this fish. Such kind of relation is indicated in table 3 where shows the males of B and C stages possess a very high percentage with the character.

第二表 次級性徵之月別變動(雄魚)

Table 2. Monthly Changes of Secondary Sexual Characteristics(♂).

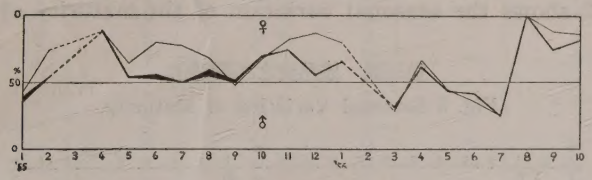
月分 Month	'55 VI	VII	VIII	IX	X	XI	XII	'56 I	II	III	IV	V	VI
	%												
全數魚 211mm 以上	35	63	45	28	83	31	64	78	—	60	91	80	86
All Fishes Above 211mm	41	71	67	71	100	45	70	93	—	60	100	100	100

2. The sex ratio.

The study of sex ratio is carried out by direct observation on the gonads of fish because as it has been found in the previous section the use of observing the secondary sex character is not appliable. The general phenomena of the sex ratio of this fish are shown in figure 2 where it is found that the male is generally more than the female but subject to monthly variation. It is found that the femle is more than the male only in January 1955 and in March to July in 1956 and rarely the ratio is 1:1. The variation of ratio in various months of the year is very irregular. It seems that the females tend to increase during spawning season.

第二圖 性比之季節變化

Fig. 2 Seasonal Changes of Sex Ratio.



3. The maturity.

a. Method of determination.

The degree of maturity is determined by direct observation on gonads of the fish. The male and female are devided into four stages as follows:

Male: A (immature).....Testis slender and threed-like.
B (premature).....Testis elongated, hard and white.
C (mature).....Testis soft, milky and milt can be squeezed out.
D (spent).....Testis soft and loose.

Female: A (immature....Ovary slender, transparent and no eggs can be observed by naked eye.
B (premature)....Ovary enlaged, eggs yellowish or duscky, can be observed by naked eye.
C (mature).....Ovary soft, full of transparent mature eggs.
D (spent).....Ovary spongy, sac-like.

第三表　次級性徵出現率與性成熟之關係(雄魚)

Table 3. Appearing Rate of Secondary Sexual Characteristics by Maturity(♂).

成熟度 Maturity		資量數 No. of Sample	次級性徵之出現 Appearing of S.S.C
A	No.	144	66
	%	100	45.8
B	No.	36	30
	%	100	83.3
C	No.	14	11
	%	100	78.6
D	No.	5	2
	%	100	40.0

b. Maturity in relation to standard length.

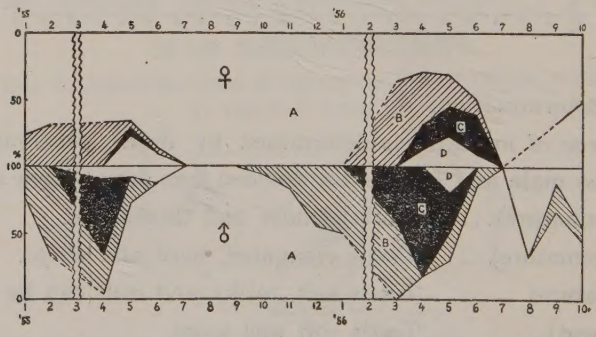
The relation between standard length and maturity is represented in table 4 from which it is found: (1). The females have the stage A appearing in body length between 16 cm and 39 cm and the other stages appear in body length not shorter than 23 cm. (2). The males have the stage A appearing in body length between 15 cm and 44 cm and all the other stages appear in body length not less than 29 cm. It is comparatively smaller than that of the matured female. No females of body length longer than 41 cm has been collected.

4. The spawing season.

The spawning season of this fish is determined by the seasonal variation of the maturity. Figure 3 shows the seasonal variation of the maturity of two years records.

第三圖　成熟度之季節變化

Fig. 3 Seasonal Variation of Maturity.



It is found: (1) In the female, the stage B begins to appear early in January and the stages C and D begin to appear in March or April and lasts until July. (2) In the male, the stages in general are rather in correspondence with that of the female except the stages B and C appearing much earlier than that in the female. It is clearly indicated that the spawning season of this fish is in the months from March or April to July and mostly in April and May.

第四表 各成熟階級之體長

Table 4. Distribution of Standard Length by Maturity.

體長 Standard Length (cm)	♂				♀			
	A	B	C	D	A	B	C	D
*								
15	1	—	—	—	—	—	—	—
16	1	—	—	—	2	—	—	—
17	4	—	—	—	5	—	—	—
18	3	—	—	—	8	—	—	—
19	7	—	—	—	17	—	—	—
20	16	—	—	—	15	—	—	—
21	12	—	—	—	19	—	—	—
22	18	—	—	—	16	6	1	—
23	13	—	—	—	23	1	0	1
24	14	—	—	—	15	3	0	0
25	15	—	—	—	12	6	1	0
26	7	—	—	—	9	3	1	0
27	13	—	—	—	16	3	2	2
28	6	—	—	—	9	2	5	0
29	9	2	—	—	6	2	4	1
30	8	1	—	1	11	8	1	5
31	7	1	—	1	5	8	0	1
32	8	0	1	1	5	8	5	4
33	1	2	0	1	4	2	0	1
34	5	0	0	0	1	5	3	1
35	3	0	1	0	0	3	2	1
36	0	2	0	0	0	0	0	2
37	3	2	0	1	2	0	0	1
38	2	1	0	0	1	0	1	—
39	4	0	2	2	1	0	0	—
40	2	2	0	1	—	1	1	—
41	1	1	0	1	—	—	—	—
42	0	0	1	1	—	—	—	—
43	0	5	0	0	—	—	—	—
44	1	1	1	0	—	—	—	—
45	—	3	1	2	—	—	—	—
46	—	2	0	1	—	—	—	—
47	—	0	0	0	—	—	—	—
48	—	1	0	0	—	—	—	—
49	—	2	1	0	—	—	—	—
50	—	—	0	0	—	—	—	—
51	—	—	0	0	—	—	—	—
52	—	—	0	1	—	—	—	—
53	—	—	0	—	—	—	—	—
54	—	—	1	—	—	—	—	—

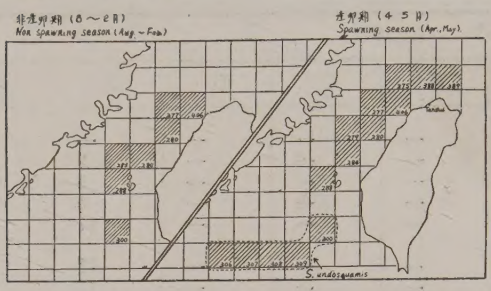
* 15 (cm) = 141～150mm

5. The spawning ground.

The samples taken are from the commercial trawlers. It is not possible to know to which fishing district each of the samples belong. The determination of the spawning ground can only be predicted indirectly by finding out the operation of the trawlers from which the samples are taken. Figure 4 is produced from the appendix table 4. from which it is clearly seen that the spawing may occur at the districts indicated because operations of the sample trawlers are concentrated in those districts during the high peak of the spawning season. Very likely the exact spot of spawing is at the districts, 280, 406, 284 and 288.

第四圖 狗母之產卵場

Fig. 4 Spawning Ground of Saurida tumbil.



CONCLUTION

The prologation of the second soft dorsal ray indicates that the Saurida tumbil possesses sexual dimophism. However, this character is not present in all the males. It seems that: (1). The smaller fish have a less percentage possessing this character than the larger ones, (2). the percentage in the large fish varies also with the degree of maturity of the fish. It is not understanbadle that some of the mature males do not possess such a character. Young specimens as small as 15 cm are found to have such character. This show that the appearing of such character is earlier in the lie history than that of the northern East Sea.

The males mature earlier than the female and also smaller. The size of both the mature males and females is found to be smaller than that of the northern East Sea.

The spawning season lasts from March or April to July but the highest peak occurs during April and May. This is also found to be later than that of the northern East Sea.

Generally, the ratio of male is higher than that of the female but subject to seasonal variation. The ratio of the female seems to increase during spawing season. The pattern of the sex ratio is found also different from that of the fish of northern East Sea.

The spawning ground of this fish is very likely along the western coast of Taiwan and west of Pen-hu Islands, very likely at the districts 406, 280, 284, and 288. That of the northern East Sea has been predicted to be along the coast of the main land.

As the spawning ground and reproduction pattern of the fish of straits are all different from that of the fish in northern East Sea, the former might be a different race or stock.

Plate 1.

Fig. 1. Saurida tumbil (Bloch).

Fig. 2. Saurida undosquamis (Richardson)

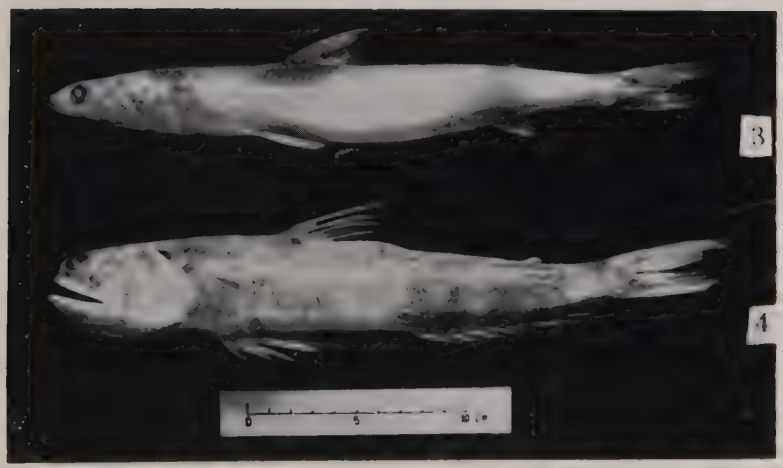


Fig. 3. Saurida elongata (T. & S.)

Fig. 4. Trachinocephalus myops (Schneider)

摘　　要

劉　發　煊　　童　逸　修

日本人對於狗母 (Saurida tumbil Bloch) 曾作各種之報告 (4, 5, 6) 但未能決定其產卵場所何在？臺灣由手操網在海峽方面所捕之狗母，常有成熟魚之發現似其產卵場所可能在臺灣海峽。茲對海峽採捕之狗母 (S. tumbil) 之生殖狀態觀察，得悉此種魚之產卵場或在海峽本島及澎湖列島沿岸之漁區如406，280，284及288諸區。

觀海峽狗母第二性徵之出現率，成熟魚之大小，產卵期及產卵場等，均與東海北部者不同，推定海峽之狗母 (S. tumbil) 或與東海北部之狗母 (S. tumbil) 爲一不同魚羣。

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Appendix

第一表　體長別次級性徵之出現率

Table 1. Appearing Rate of Secondary Sexual Characteristics by Standard Length.

體長 Standard Length	資料數 No. of Sample	出現率 Appearing Rate of S.S.C. No.	%	體長 Standard Length	資料數 No. of Sample	出現率 Appearing Rate of S.S.C. No.	%
16	2	—	—	29	7	6	86
17	4	—	—	30	14	13	93
18	3	—	—	31	10	10	100
19	14	1	7	32	16	13	81
20	10	1	10	33	4	4	100
21	13	2	15	34	5	2	40
22	11	2	18	35	4	4	100
23	18	9	50	36	1	1	100
24	11	7	64	37	1	1	100
25	12	6	50	38	2	1	50
26	9	5	56	39	1	1	100
27	16	12	75	40	—	—	—
28	11	9	82				

第二表　性比之季節變化

Table 2. Seasonal Changes of Sex Ratio.

a. 全數魚　All Fishes.

性別 Sexes	月份 Month	'55 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	'56 I	II	III	IV	V	VI	VII	VIII	IX	X
♀	No.	22	16		3	21	22	19	17	18	8	11	18	10		11	7	13	10	3	0	3	2
	%	61	47		12	46	44	50	41	49	31	27	45	35		69	39	57	59	75	0	25	18
不明 Obscurity	No.						2		2	1													
	%						4		5	2													
♂	No.	13	18		23	25	26	19	22	18	18	29	22	18		5	11	10	7	1	9	9	9
	%	36	53		88	54	52	50	54	49	69	73	55	65		31	61	43	41	25	100	75	82
合計 Sum	No.	36	34		26	46	50	38	41	37	26	40	40	28		16	18	23	17	4	9	12	11
	%	100	100		100	100	100	100	100	100	100	100	100	100		100	100	100	100	100	100	100	100

b. 雌魚 281 mm 以上，雄魚 211 mm 以上。　Above 281mm in female, Above 211mm in male.

性別 Sexes	月份 Month	'55 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	'56 I	II	III	IV	V	VI	VII	VIII	IX	X
♀	No.	7	5		3	12	6	5	7	8	4	2	3	3		12	5	10	9	3	0	1	1
	%	58	26		12	36	21	23	32	53	33	18	13	20		71	33	56	64	75	0	11	13
♂	No.	5	14		23	21	22	17	15	7	12	20	20	15		5	10	8	5	1	9	8	7
	%	42	74		88	64	79	77	68	47	67	82	87	80		29	67	44	36	25	100	89	87
合計 Sum	No.	12	19		26	33	28	22	22	15	16	22	23	18		17	15	18	14	4	9	9	8
	%	100	100		100	100	100	100	100	100	100	100	100	100		100	100	100	100	100	100	100	100

第三表　成熟度之季節變化

Table 3. Seasonal Variation of Maturity.

成熟度 Maturity		月份 Month	'55 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	'56 I	II	III	IV	V	VI	VII	VIII	IX	X
♀	A	No.	17	11		2	14	19	19	17	18	8	11	18	10		4	2	4	5	3	0	2	1
		%	77	69		67	66	86	100	100	100	100	100	100	100		36	29	31	50	100		67	50
	B	No.	5	5		1	1	1	0	0	0	0	0	0	0		7	2	3	1	0	0	0	0
		%	23	31		33	5	5	0	0	0	0	0	0	0		64	29	23	10	0		0	0
	C	No.	0	0		0	1	0	0	0	0	0	0	0	0		0	2	3	3	0	0	0	0
		%	0	0		0	5	0	0	0	0	0	0	0	0		0	29	23	30	0		0	0
	D	No.	0	0		0	5	2	0	0	0	0	0	0	0		0	1	3	1	0	0	1	1
		%	0	0		0	24	9	0	0	0	0	0	0	0		0	13	23	10	0		33	50
	合計 Sum	No.	22	16		3	21	22	19	17	18	8	11	18	10		11	7	13	10	3	0	3	2
		%	100	100		100	100	100	100	100	100	100	100	100	100		100	100	100	100	100		100	100
♂	A	No.	10	6		1	18	23	19	22	18	17	24	12	9		0	2	3	6	1	3	6	4
		%	77	33		4	72	88	100	100	100	94	83	55	50		0	18	30	86	100	33	67	44
	B	No.	3	12		7	5	0	0	0	0	1	5	10	9		3	0	2	1	0	0	2	1
		%	23	67		30	20	0	0	0	0	6	17	45	50		60	0	20	14	0	0	22	12
	C	No.	0	0		13	0	0	0	0	0	0	0	0	0		2	9	3	0	0	0	0	0
		%	0	0		57	0	0	0	0	0	0	0	0	0		40	82	30	0	0	0	0	0
	D	No.	0	0		2	2	3	0	0	0	0	0	0	0		0	0	2	0	0	6	1	4
		%	0	0		9	8	12	0	0	0	0	0	0	0		0	0	20	0	0	67	11	44
	合計 Sum	No.	13	18		23	25	26	19	22	18	18	29	22	18		5	11	10	7	1	9	9	9
		%	100	100		100	100	100	100	100	100	100	100	100	100		100	100	100	100	100	100	100	100

第四表　供試漁船作業漁區

Table 4. Fishing District of Sample Trawlers.

月份 Month	1955 I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
作業漁區 Fishing District	300 280 280	280 288		300 280 309 406 280 279	307 279 308 406 288 388 284 279	284 284 280 283	288 288 284 284 283 280 277 279	284 284 283 288	280 406 284	280 280 288	280 280	280 280
船名 Trawler Name	臺漁 26 27 號 臺漁 81 82 號	臺漁 3 7 號 臺漁 1 2 號		臺漁 81 82 號 臺漁 101 102 號	臺漁 101 102 號 臺漁 26 27 號	臺漁 3 7 號 漁澎 1 2 號	臺漁 81 82 號 臺漁 23 25 號	集友 1 2 號 臺漁 101 102 號	臺漁 81 82 號	臺漁 1 2 號 集友 11 12 號	集友 51 52 號 集友 31 32 號	集友 51 52 號 集友 11 12 號

月份 Month	1956 I	II	III	IV	V	VI	XI	VIII	IX	X		
作業漁區 Fishing District	280 280 277		288 280 280	309 306 288 406 288	275 277 389 300 307	不明	284	284	284	280 406		
船名 Trawler Name	臺漁 1 2 號 臺漁 3 7 號		集友 51 52 號 集友 11 12 號	漁澎 1 2 號 臺漁 3 7 號	集友 51 52 號 海慶	集友 51 52 號	集友 31 32 號	臺漁 101 102 號	集友 51 52 號	集友 21 22 號		

STUDIES ON THE ELASMOBRANCH FISHES FROM FORMOSA. PART II. A NEW CARCHAROID SHARK, *CARCHARIAS YANGI*, FROM FORMOSA.

(With 1 Figure)

By

HUO-TU TENG*

In December 1956, a specimen of carcharoid shark was obtained by Mr. Hung-tsia Yang, my assistant in the Taiwan Fisheries Research Institute, at Su-ao fish market, caught by bottom long line off the coast of Su-ao, a fishing port situated at the north-eastern coast of Formosa (Lat. 24°36′ N., Long. 121°52′ E.). After careful examination, it proved to represent a new species, and described here under the new name of *Carcharias yangi*, named in honor of the collector. I am indebted to professor Dr. Yu-hsi Moltze Wang and Dr. F. H. Liu, Department of Zoology, National Taiwan University, for reading the manuscript.

Carcharias yangi, new species

Head (snout to 5th gill openings) 3.20 in body length (snout to subcaudal origin); depth 7.00; interorbital 11.40. 1st or 5th gill opening length 4.30 in head; 2nd or 3rd gill opening length 4.00. Interorbital space equals snout length or mouth width, twice as broad as the diameter of eye.

Body fusiform, tail tapering moderately behind; head little depressed, flattened above. Snout medium, conical, twice as long as eye, acutely pointed in profile, rather pointed in upper view. Eye round and large, little larger than the internarial space, nearer to tip of snout than to first gill-opening; nictitating membrane absent; interorbital space flattish and broad, twice as board as the diameter of eye. Nostril transverse, much nearer to mouth than to tip of snout, anterior nasal margin with a short rounded nasal valve on its inner half, posterior nasal valve with a pointed lobe and a small fold on its inner margin, mouth very large, strongly arched, the cleft extends much beyond the posterior margin of eye, front margin of lower jaw below the post one fourth of the diameter of eye; upper labial fold much longer than lower one. Teeth alike in both jaws, lanceolate, slender, curved inward, root forked, arranged as 14–0–15 above, 13–0–13 below; third upper tooth very small, upper jaw from the fourth tooth and lower from the third progressive smaller posteriorly, both jaws except third, fourth, eighth, and ninth teeth with small or rudimentary basal cusps on each side or only outer side of the median large cusps, the others without basal cusps. Spiracle minute,

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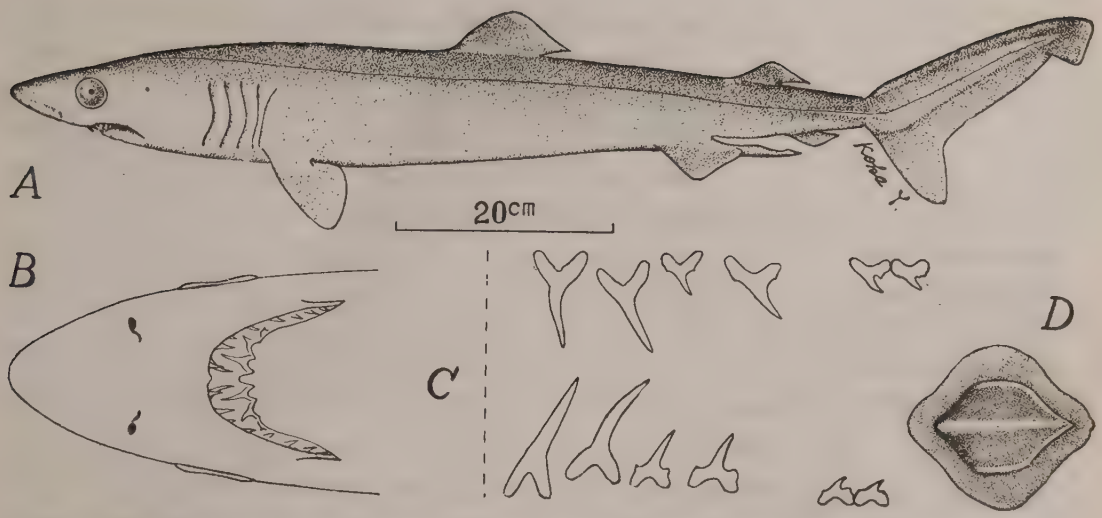

Fig 1. *Carcharias yangi*, new species, holotype, male, 1,000 mm in total length (Taiwan Fisheries Research Institute Fish Specimen No. 2895), from off Su-ao. Drawing by Mr. Hung-tsia Yang. A, lateral view. B, ventral view of anterior part of head. C, upper and lower teeth (1st, 2nd, 3rd' 4th, 8th and 9th), left hand side of mouth, enlarged, midpoint of jaws marked by the dotted line. D, dermal denticles, from side below first dorsal fin, enlarged.

behind the eye, above the angle of the mouth. Gill-openings very wide, twice as long as the diameter of eye, two and two-fifth times wide of the internarial space, hindmost in front of the pectorals, under margin of gill opening slightly above the level of origin of pectorals.

First dorsal much larger than second dorsal or anal fin, inserted just midway between tip of snout and caudal base. Second dorsal above the space between bases of ventral and anal, base half of it of first dorsal, and shorter than one-fourth of its distance from that of the first dorsal. Pectoral small, about two-fifth of length of head, its inner angle broadly rounded. Ventral smaller than first dorsal, just in front of second dorsal and much separated from first dorsal. Anal smaller than any other fins, inserted more posteriorly than hind end of second dorsal base. Caudal moderate, lower lobe bluntly produced in front; caudal notch evident. Dorsals and anal produced posteriorly. Caudal peduncle short, width epuals its depth, with rather deep pits at root of caudal, and with lateral weak keel on each side.

Body finely roughend, scales small, subsessile, with expanded, irregullar diamond shaped base, upper surface with three keels which converge towards a median cusp.

Color dark brown above and sides, dark grey on the lower surfaces; all the fins dark brown, distal margin of fins narrowly whitish.

Type specimen is a male, 1,000 mm in total length, Taiwan Fisher. Res. Inst. Fish Spec. No. 2895. The measurements of type specimen are as follows (in mm):

Total length.....1,000

Length from tip of snout to: origin of subcaudal.....782

origin of 1st dorsal.....403

origin of 2nd dorsal.....663

origin of pectorals....235
origin of ventrals....593
origin of anal....713
5th gill opening....243
front margin of eye....60
front margin of mouth....76

Interorbital space....58
Breadth of mouth....59
Eye: horizontal diameter....30
Internarial space....25
Length of bases: 1st dorsal....85
2nd dorsal....41
Ventral....53
Anal....27
Distance between dorsals....179
Depth of body....111
Caudal fin: depth....29
width....28
Gill opening lengths: first....57
second....62
third....62
fifth....57

The present species resembles closely to the Japanese species *Carcharias kamoharai* MATSUBARA, but differs from it in having small spiracles behind the eyes and above the angle of the mouth (spiracles are absent in the latter), and having the teeth partly with either small or rudimentary basal cusps (without basal cusp in the latter), between angle of mouth and first girst gill-opening having no large white blotch (have a large white blotch in the latter), in having caudal peduncle somewhat round, the width equals its depth, and with a weakly developed lateral keel on each side (Caudal peduncle somewhat depressed, wider than deep, but lateral keel absent in the latter).

摘　　要

鄧　火　土

一九五六年十二月二日，臺灣省水產試驗所楊鴻嘉君於蘇澳魚市場採得砂鮫科魚類標本一尾，經作者鑑定爲一新種，命名爲楊氏砂鮫 (Carcharias yangi)。

楊氏砂鮫之體長(吻端至尾鰭下葉起點)爲頭長(吻端至第五鰓孔)之 3.20；爲體高之 7.00；爲眼窠間隔之11.40。頭長爲第一或第五鰓孔長之4.30；爲第二或第三鰓孔長之 4.00。眼窠間隔與口吻之長或寬相等；爲眼徑之 2 倍。魚體側背爲深棕色，腹面爲深灰色。各鰭爲深棕色，邊緣有窄小之白帶。

本種與日本產之 Carcharias kamoharai MATSUBARA 很相似，但有下列相異之處。眼後之口角上方有噴水孔(後者無)；齒部份有小或發育不全之基底尖頭(後者無)；在口角與第一鰓孔之間無白色大斑點(後者有一白色大斑點)；尾柄近於圓形，寬與高相等，兩側各有一弱稜脊(後者之尾柄略扁，寬大於高，兩側無稜脊)。

本種最初於民國四十七年一月，以中文發表於中國水產(見該誌第六十一期，臺灣產未記錄鮫類)。惟該時參考資料不詳，僅以 Carcharias sp. 名之。

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THE DISTRIBUTION AND FLUCTUATION OF SOME DEMERSAL FISHES OF TAIWAN STRAITS.

By

Liu Fah-hsuen and Chen Gin Chen

INTRODUCTION

The distribution of demersal fishes in the region of the East and Yellow Seas, North of 25°N has been studied by Kashara (1) which has been reviewed concisely by Liu (2). Some work has also been done by Seikai Regional Fisheries Research Laboratory, Nagasaki, Japan (3). Later Liu and Tung based on the data collected from the log books of the 19 trawlers of the Chinese Fisheries Cooperation, formerly the Fisheries Rehabilitation Administration has made an intensive study especially on the region between 25°N and 27°30'N, the Northern Trawling Ground of Taiwan which is an important fishing ground of Taiwan trawl fishery (4). Knowledge about the distribution of the demersal fishes of the region South of Taiwan, 23°N up to Bay of Tung King can be secured from the investigation records of the Shao Nan Investigation Boat which has been reviewed by Liu and Chen (5) and Liu and Liu (6). Besides, Chen (7) has made a preliminary report in Chinese on the region of the Taiwan Straits, the region between 22°N and 25°N no other work can be found and hence a gap which handicaeped the understanding of fish population on the two ends of Taiwan is worthwhile to know. By using the same method of analysis as that used in previous report (4) the writer has adopted the fishing records of six pairs of bull trawlers of the years 1950–1955 for the present investigation. The six pairs of bull trawlers belong to the former Taiwan Provincial Fisheries Company.

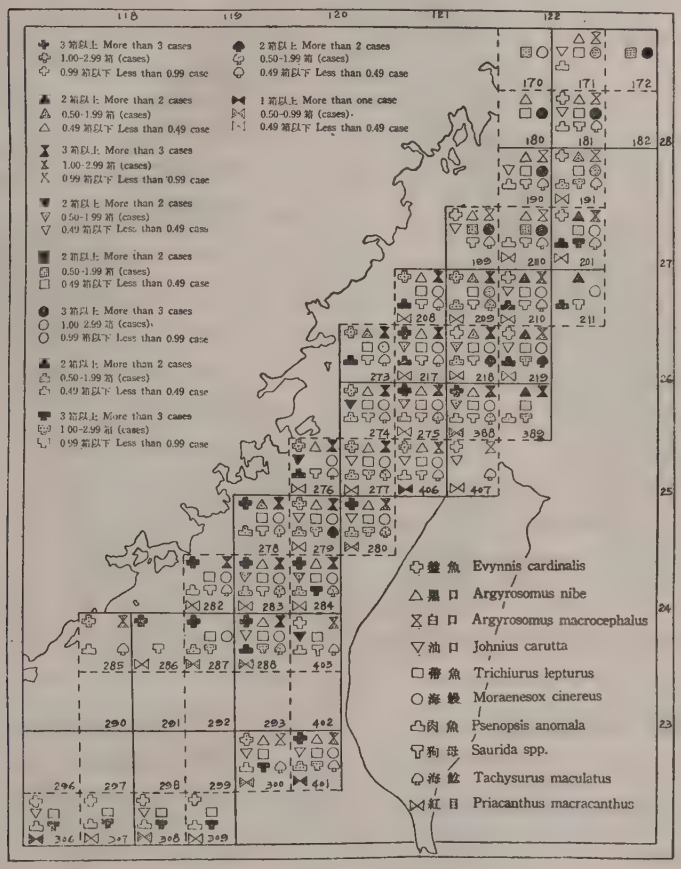
OBSERVATION

I. The important species of fish of this region (22°N and 25°N) and their general distribution (Fig. 1).

There are quite a number of fishes which are produced in this region possess commercial value but what are produced in large quantities are 1. Evynnis cardinalis, 2. Argyrosomus macrocephalus, 3. Saurida tumbil, 4. Johnius carutta, 5. Priacanthus macracanthus, 6. Muraenesox cinereus 7. Tachysurus maculatus, 8. Psenopsis anomala, 9. Trichiurus lepturus, 10. Argyrosomus nibe. It is clearly shown in figure 1 that these fishes are rather scattered in the districts of the region and are as that shown in the Northern Trawling ground where most important species are usully concentrated in several fishing districts (4). It is also seen that some of the fishes are northern origion such as Muraenesox cinereus, Trichiurus lepturus, Argyrosomus nibe, Psenopsis anomala and Johnius carutta and some are characteristic of this region as Saurida tumbil, the Argyrosomus macrocephalus, Evynnis cardinalis, Priacanthus macracanthus and

第一圖 臺灣海峽10種主要底棲魚的分佈

Fig. 1. General Distribution of 10 Important Demersal, Fishes (Detween the region of 22°N & 25°N.) of the Taiwan Strait.



Tachysurus maculatus.

II. Distribution and fluctuation of Muraenesox cinereus (Fig. 2).

These fish appear very few in this region, but comparatively more in the Southern districts as 280 and few in districts south of latitude 25°N. They are very rare in region south of 23°N as they only appear in June in district 401. As data are too few to be viewed upon, it is difficult to interprate their fluctuation in abundance in various fishing districts and in different season. However, it seems that those found in this region are coming from the sea north of the investigated area becuse they are found more abundant in the north and those come from the north do make their residence in district 280, although some of them may return to the north, for they are found presenst in district 280 almost in all months of the year.

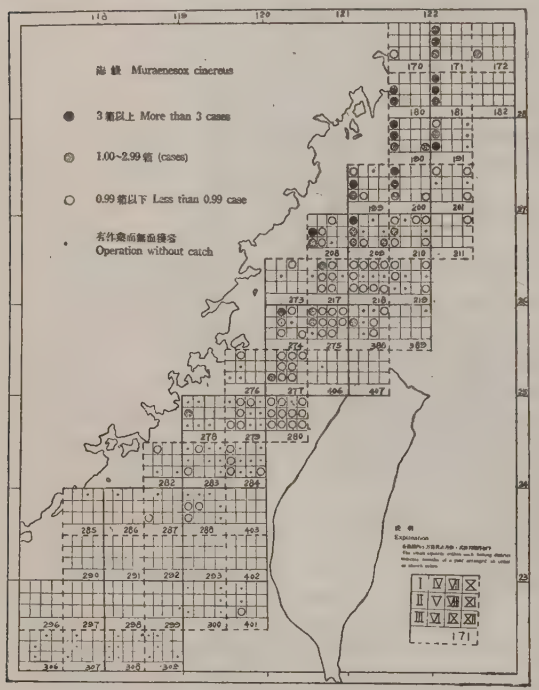
III. Distribution and fluctuation of Argyrosomus nibe (Fig. 3.).

These fishes are as the eel coming from the north to this region. They are concentrated in districts 280 and 284 but their distribution extends rarely up to districts 300 and 401. Some of them are also found to make residence in district 280.

IV. Distribution and fluctuation of Trichurus lepturs (Fig. 4).

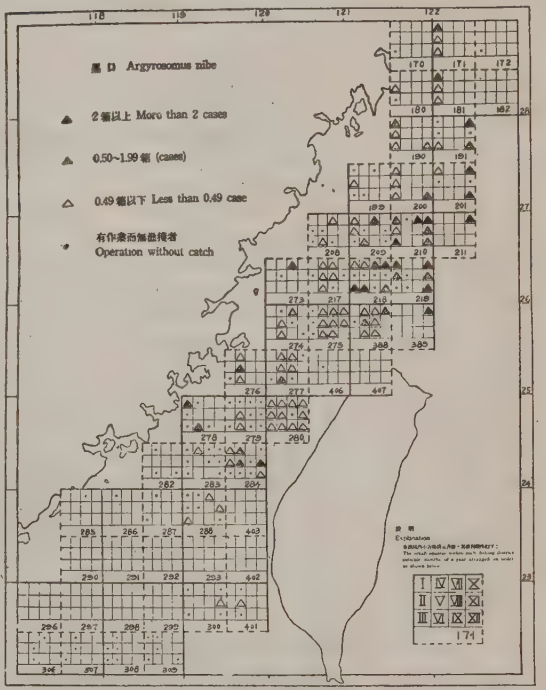
第二圖　海鰻的分佈

Fig. 2. The Distribution of Muraenesox Cinereus



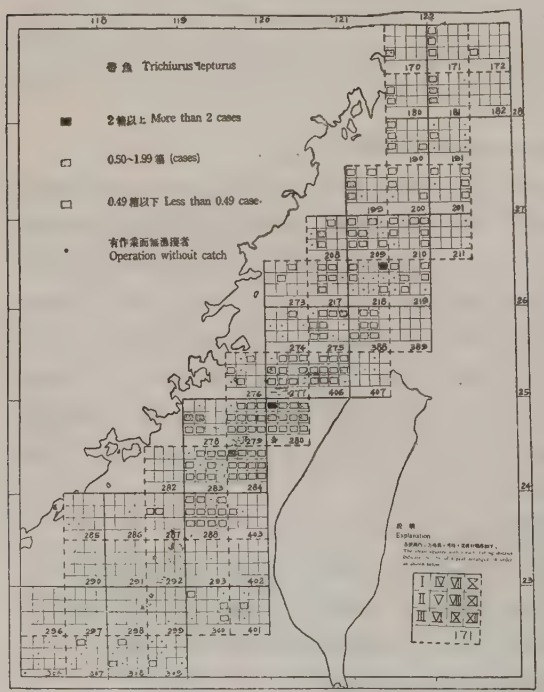
第三圖　黑口的分佈

Fig. 3. The distribution of Argyrosomus nibe.



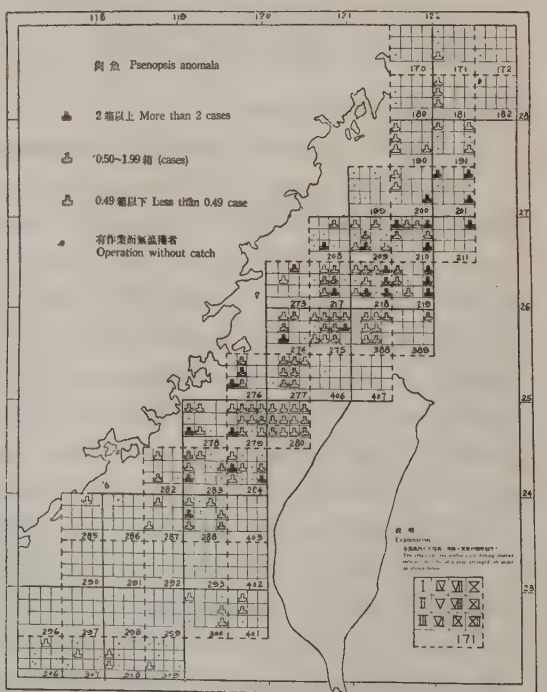
第四圖　白帶魚的分佈

Fig. 4. The Distribution of Trichiurns lepturus.



第五圖　肉魚的分佈

Fig. 5. The Distribution of Psenopsis anomala.



These fish are found to concentrate in districts 279, 280, 283, 284, and 288. Some wondering to further south in districts between latitude 22°N and 23°N but very rare. Seen from the districts 280 and 284, they appear in all months of a year and the highest concentration is found in January. They are foud more concentrated in months like, Febrary, November and December.

V. The distribution and fluctuation of Psenopsis anomala (Fig. 5).

These fish of this region are of the northern origin for the same reason as observed in the distribution pattern of the above species. They are found to concentrate in districts 278, 279, 280, 284, 283 and 288 but their concentration varies with different month in different districts. For instance, they are, found in all months of the year in district 280 but more aboundant in spring (January to March) and in winter (October to December) and in district 284 the concentration is found to be highest in Febuary and December and absent or few in other months. The highest concentration are found in district 288 in February and in districts 283, 278 and 279 in March. There is a tendency in all districts where if they are present in most of the months, which indicates that they are more concentrate in spring and winter months and are absent or few in months from April to september in the more the southern districts. They can be found in districts as far south as 306, 307, 308 and 309.

VI. The distribution and fluctuation of Johius carutta (Fig. 6).

These fish are also comparatively few in this region. The concentration centers are found in the sea north of latitude 25°N. They are distributed in this region as district 401, but high concentration is found in December and February in districts 284, and 288 and in April in districts 283 and 279.

VII. The distribution and fluctuation of Tachysurus maculatus (Fig. 7).

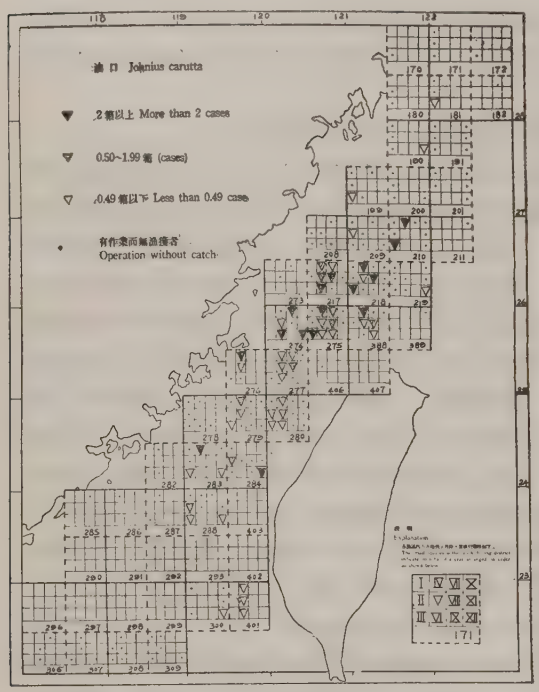
These fish are characteristic of this region. However, there is also a concentrated area in the north. They are found thoughout the year in districts 280, 279 and 284 in different concentration by different month. The highest concentration is found in July and December in district 280, July and September to December in district 279, April to August in district 284, September in district 278, August in district 283 and May and December in district 288. They can also be found in southern districts as 300 and 401.

VIII. The distribution and fluctuation of Saurida tumbil (Fig. 8).

These fish are also charcateristic of this region. As indicated in the figure, besides the concentarated center in districts 279, 280 and 284 two other fishing centers can be found, one in the north between 27°N and 28°N and the other in the south between 22°N and 23°N. That found in southern districts is known to be Saurida undosquamis that of the northern center is not known. It is apparent that these fish of this investigated area are of two species and they fluctuates differently with the change of season. Generally the density of Saurida tumbil is found to be higher in districts 278, 280, in spring and Winter and that of the southern districts, the Saurida undosquamis is higher during the upper half of the year. It is unable to know whether the Saurida tumbil of this region bears any relation with that of the northern region.

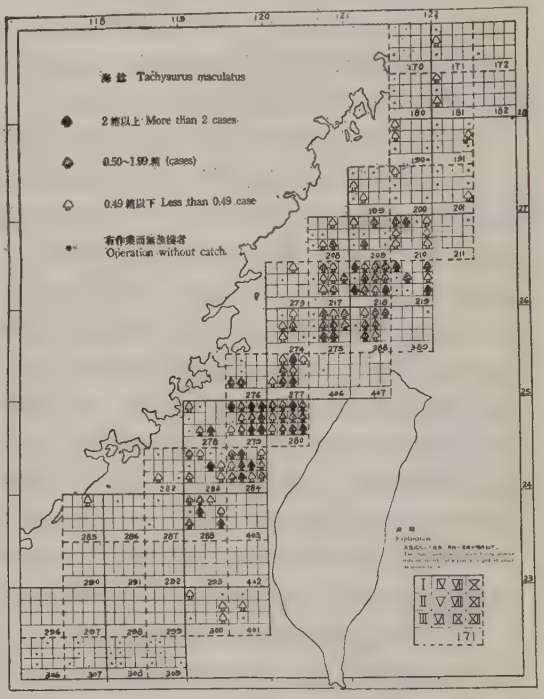
第六圖　油口的分佈

Fig. 6. The Distribution of Johnius carutta.



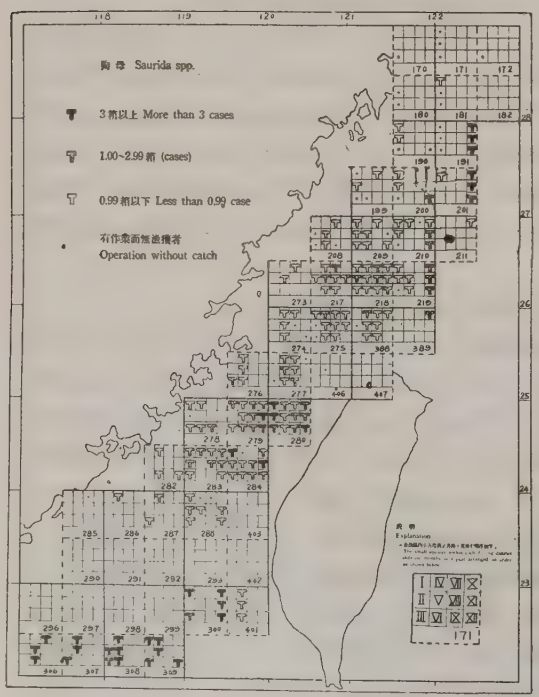
第七圖　海鯰的分佈

Fig. 7. The Distribution of Tachysurus maculatus



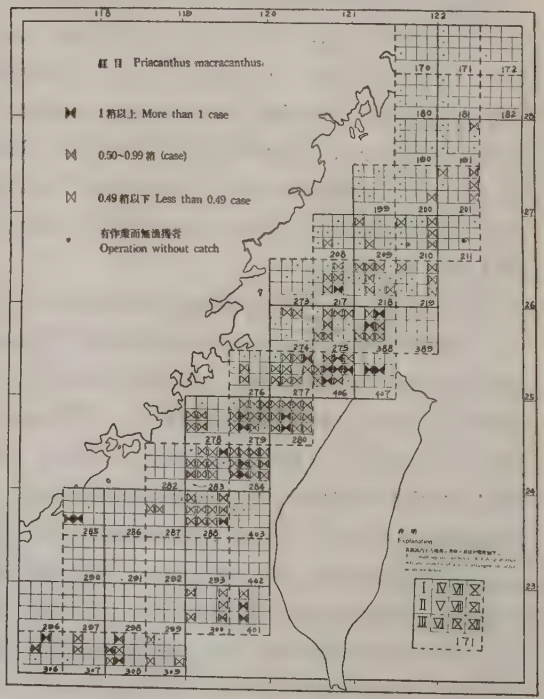
第八圖　狗母的分佈

Fig. 8. Distribution of Saurida tumbil



第九圖　紅目的分佈

Fig. 9. The Distribution of Priacanthus macracanthus.



Also whether the Saurida undosquamis migrates sometime north to mix with the Saurida tumbil is not possible to be investigated with the presend data which do not tell the records of different species.

IX. The distribution and fluctuation of Priacanthus macracanthus (Fig. 9).

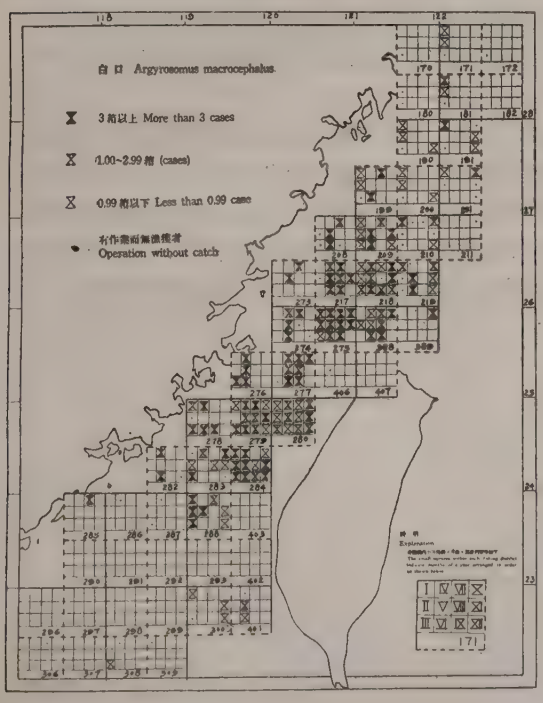
These fish are also characteristic of this region. The districts in which they are more concentrated and are found throughout the year are 279, 280, 283, 284 and 288. Their distribution extends southernly up to latitude 22°N and northernly as far as 28°N. It is generally seen that they generally appear more aboundantly during summer time (April to June) but in districts 288 and 283 their abundance is shown during winter (October to December). Their concentration are also seen in the sea north of this investigated region between latitude 25°N and 26°N. How that of this region is related to that of the north is not clearly seen.

X. The distribution of Argyrosomus macrocephalus (Fig. 10).

These fish are again characteristic of this region. They like the Priacanthus macracanthus, are concentrated in districts 278, 279, 280, 284 and 288. Their presence can be seen in the snouth as far as district 308. They are found throughout the year in districts 279, 280 and 284 but is generally seen that their abundance is much higher in spring and winter. There is an another center found outside of this region in the north in districts 276, 277, 275, 217 and 218 where they are found more abundant generally in summer and autumn. It is likely that these fish migrate southernly during

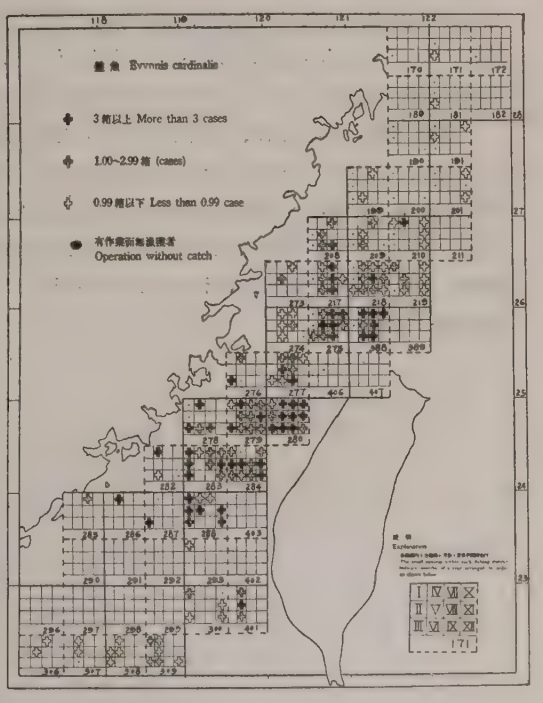
第十圖 白口的分佈

Fig. 10. The Distribution of Argyrosomus macrocephalus.



第十一圖 鰆魚的分佈

Fig. 11. The Distribution of Evynnis cardinalis



cold moths and northernly during warm months if the data indicate the records of same species.

XI. The distribution and fluctuation of Evynnis cardinalis (Fig. 11).

The distribution pattern of these fish is very much like that of Argyrosomus macrocephalus. They are almost distributed through out the districts of the investigated area. They are concentrated in this region in the districts 279, 280, 283, 284, and 288. Their concentration is high in almost all the months in district 280, but in other districts their aboundance is found to be high in spring and winter. There is also an another concentrated area found outside of this region as the districts 217, 218, 275, 388 and 277 were their aboundance is found also like Argyrosomus macrocephalus higher during summer months. For this reson, it might he also that these fish have a northward and southward movement in compansate with the warm and cold climates.

CONCLUSION

It is clearly seen that the fishes investigated are of two origin, one consists fishes come from north which only concentrates in this region during cold months and the other consists of fishes characteristic of the investigated region which are used to go north during warm months. The fishes of the former are Muraenesox cinereus, Trichiurus lepturus, Argyrosomus nibe, Psenopsis anomala and Johnius carutta, that of the latter are Argyrosomus macrocephalus, Evynnis cardinalis, Priacanthus macracanthus and Tachysurus maculatus. Johnius carutta may be misinterpeted as a species characteristic of the strait because they are not caught by otter trawlers. It seems that these fish inhabit in shallower waters. The Saurida tumbil may easily be misinterpreted as a species of southern origin if that present in districts between latitude 22°N and 23°N is not known as a different species.

The districts 278, 279, 280, 283, 284 and 288 are the districts of this region where the investigated fishes are concentrated and the districts 280 and 284 seem to be the residence of these fishes because many of them can be found there throughout the year. However, they fluctuate in abundance in different months of a year. Generally, these fishes concentrate in these regions during cold months and less aboundant in summer months.

摘　　要

劉發煊　　陳金城

利用臺灣水產公司六對手操網漁獲記錄，對臺灣海峽十種重要底棲魚類之分佈及其變化作觀察。查此十種底棲魚類如黑口、帶魚、海鰻、油口，及肉魚，爲北部拖網魚場之重要魚類，每年寒冷季節，集聚海峽越冬，至白口、狗母、海鯰，紅目鰱及盤魚則爲海峽產品，每年暖熱季節移聚於北部拖網漁場中心。

海峽區內此十種重要魚類之分佈，幾占全海域各漁區，惟其密度較高之漁區則爲 278，279，280，283，284，及 288 諸區，成爲海峽區之中心漁場，尤其 280 及 284 兩區，幾終年有此種魚類之出現，但各種魚類在各月份出現之密度不同，一般而論，春冬季節密度較高。

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ANCHOVIES FOUND IN TAIWAN

by

SHEN SHIH-CHIEH

Reports concerning the economical value, the production, fishing ground, fishing methods and the activity of herring-like fishes are published in Chinese Fisheries Monthly vol. 30, and Report of The Institute of Fishery Biology Vol. I, No. 2. These fishes are very complicated and the species in each Family are quite alike. Therefore, the separation of these fishes into different groups is not easy. The total catch of anchovies in 1957 amounted to more than 5,499 metric tons, which is 40% of the catch of herring-like fishes. Hence the anchovies are very important in connection with the economy of Taiwan, so it necessitates the fundamental research of these fishes from the view point of systematics. It appears that the taxonomical studies of these fishes hitherto made are far from complete in many respects since they vary so much according to individuals, and growth-stages that they are apt to be taken as one species for their appearance. The present paper is going to give a review of 12 species of anchovies known to inhabit the waters of Taiwan, including 5 unrecord species. The specimens are collected by the writer during March, 1955 to December 1958 at Keelung, Badoz, Tamsui, Tainan, Kaohsiung., Tongkong and Pescadore Islands. Series of the species obtained have been deposited in the laboratory of the Institute of Fishery Biology.

The measurements taken are as follows: (1). the length of body is indicated by a measurement from the tip of snout to the base of the middle ray of caudal fin; (2). the depth of body by that of the perpendicular depth immediately in front of the base of dorsal fin; (3). the length of head is the distance from the most anterior portion on the snout to the most distant point on the opercular membrane; (4). height of the head is measured from the anterior margin of the eye vertically down-ward to ventral contour of the head.

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KEY TO GENERA

a_1 Body more or less compressed, abdominal scutes from gill-opening to vent.

b_1 Upper pectoral ray produced, anal 56.....Setipinna.
b_2 Upper pectoral ray not produced, anal 35–42,
maxillary reaching at least to gill-opening.....Thrissa.
a_2 Body more or less robust partly cylindrical, abdominal scutes absent or present between pectorals and ventrals..
c_1 Silvery band absent, (ov present in young stage),
no abdominal scutes.....Engraulis.
c_2 Silvery band present, abdominal scutes between
pectorals and ventrals.....Stolephorus.

Geuns SETIPINNA Swainson

Setipinna taty (C. V.) Plate 1, Fig. 1

Body oblong, very compressed, dorsal and ventral profile evenly convex. Mouth oblique. Maxillary broad and truncated behind, extending a little beyond mandibulary joint. Snout rounded, hardly projecting about 3/4 of eye. Teeth in narrow band in jaws, extending along maxillary edge, on palatines and tongue. Lower gill-rakers 16-17, longest 4.08–4.58 in head.

Head 5.09–5.91, depth 3.04–3.33 in standard length. Snout 4.58–5.44, horizontal diameter of eye 3.50–3.92, postocular portion of head 1.61–1.68, height of head 1.16–1.26, least depth of caudal peduncle 2.11–2.41, length of caudal peduncle 2.47–2.50 in head. Distance from tip of snout to origin of dorsal 2.11–2.15, to origin of ventrals 2.70–2.80, to origin of anal 1.98–2.12 in standard length.

Dorsal I. 13–14, longest ray 1.00–1.17, base 1.30–1.44 in head. Its origin is behind origin of ventrals or nearer to the tip of snout than to base of caudal. Anal 56, longest ray 1.96–2.86, in head, anal base 2.05–2.18 in standard length, origin below dorsal. Pectoral 12–13, upper pectoral ray produced, reaching to origin of anal, which is 3.34–3.71 in standard legth. Ventral 7, longest ray 2.40–2.89 in head.

Scales 43–45 in lateral median series, 12 transversely, more deciduous. Abdominal scutes 17–19+7–8. Predorsal 32–34.

Colouration: Darker and brown back, silvery belly. Fins hyaline, caudal brownish along its margin.

Described from 3 specimens 165–183 mm in total length, 140–154 mm in standard length, collected in Keelung.

Genus THRISSA Cuvier

KEY TO SPECIES

a_1 Maxillary not reaching beyond opercle.
b_1 Head 3.30–3.55, gill-rakers 28–32, abdominal
scutes 23–25.....*Thrissa kammalensis.*
b_2 Head 4.12–4.97, gill-rakers 13–15, abdominal scutes
27–29.....*T. hamiltoni.*

a_2 Maxillary reaches at least to pectorals.

c_1 Maxillary surpasses to pectorals or nearly reaches to ventrals, gill-rakers 17–18, abdominal scutes 21–23.....*T. dussumieri.*

c_2 Maxillary surpasses ventrals, gill-rakers 10–12, abdominal scutes 24–27.....*T. setirostris.*

Thrissa kammalensis (Blkr.) Plate 1, Fig. 2.

Body oblong, compressed, ventral profile more convex than dorsal. Snout very prominent, about equal to eye. Maxillary expanded above mandibulary joint, tapering behind, extending to gill-opening. Teeth in jaws, on vomer, palatines, pterygoids, tongue and one raw extend along maxillary edge. Upper surface of head with a median keel. Lower gill-rakers 28–32, spinulous, longest 4.54–4.74 in head. Vertebrae 18–19+21–22.

Head 3.63–4.28, depth 2.50–3.04 in standard length. Height of head 1.42–1.58, snout 4.00–4.55, horizontal diameter of eye 3.53–4.20, post-ocular portion of head 1.62–1.89, least depth of caudal peduncle 2.56–2.97, length of caudal peduncle 3.00–3.79 in head. Distance from tip of snout to origin of dorsal 1.87–2.05, to origin of ventral 2.05–2.23, to origin of anal 1.44–1.56 in standard length.

Dorsal I. 13–14, free spine nearly imbedded, longest dorsal ray 1.05–1.63, dorsal base 2.12–2.91 in head. Its origin is behind origin of ventrals or midway between tip of snout and caudal base. Anal 29–34, origin behind end of dorsal, longest ray 2.00–2.32, anal base 1.05–1.24 in head, Ventral 7, longest ray 2.20–2.60 in head. Pectoral 11–14, longest 1.51–1.84 in head.

Scales 35–38 in median lateral series, 9–10 transversely, 15–16 predorsal, thin with transverse lines or some with anastomosing lines posteriorly. Abdominal scutes 15–16+8–9.

Coloration: Silvery belly, darker above, usually blackish spot across nape and downwards to scapula. Fins hyaline, caudal usually blackish along margin.

Described from 35 specimens 84.0–93.5 mm in total length and 66.2–74.0 mm in standard length, collected in Tamsui.

Thriessa hamiltoni (Gray) Plate 1, Fig. 3.

Body oblong, compressed, dorsal and ventral profile about equally convex, snout rounded, scarcely prominet smaller than eye. Maxillary reaches little beyond gill-opening or nearly to pectoral origin. Teeth in jaws, on vomer, smaller and in narrow band on each palatines, pterygoids, tongue and one raw extend along maxillary edge. Upper surface of head with a median keel. Lower gill-rakers 13–15, longest 4.19–4.98 in head. Vertebrae 20–21+24–25.

Head 4.12–4.97, depth 3.25–4.58 in standard length. Height of head 1.12–2.70, snout 4.00–5.83, horizontal diameter of eye 3.57–4.88, postocular portion of head 1.44–2.06, least depth of caudal peduncle 2.00–2.67, length of caudal peduncle 2.66–3.11 in head. Distance from tip of snout to origin of dorsal 1.83–2.04, to origin of ventral 2.33–2.71, to origin of anal 1.52–1.80 in standard length.

Dorsal I. 12–14, longest dorsal ray 1.23–1.63, base 1.51–2.69 in head. Its origin is behind origin of ventrals or midway between tip of snout and caudal base. Anal 36–42, origin below or behind end of dorsal, longest ray 1.62–2.06 in head, base 2.36–3.67 in standard length. Ventral 7, small, longest ray 2.40–3.02 in head. Pectoral 11–13, longest ray 1.07–1.45 in head.

Scales 42–46 in median lateral series to caudal base, 11–12 transversely, 16–18 predorsal. Abdominal scutes 17–19+10–11.

Colouration: Silvery belly, back dark, scapular region with black venules, fins hyaline, sometimes dorsal and pectorals dusky.

Described from 30 specimens 51.0–234.0 mm in total length and 41.2–189.0 mm in standard length, collected in Tamsui, Tungkong and Tainan.

Thrissa dussumieri (Valenciennes) Plate 1, Fig. 4.

Body oblong, compresed, dorsal profile about as convex as the ventral. Snout prominent. Maxillary reaches nearly to the ventrals. Teeth small in jaws, on vomer, Palatines, peterygoids, tongue, and one raw extend along maxillary edge. Lower gill-rakers 17–18, longest 4.00–4.43 in head. Vertebrae 17–18+23–24.

Head 3.97–4.16, depth 3.07–4.04 in standard length. Height of head 1.07–1.81, snout 4.24–5.73, horizontal diameter of eye 3.83–4.39, postocular portion of head 1.60–1.89, least depth of caudal peduncle 2.12–2.60, length of caudal peduncle 2.33–2.80 in head. Distance from tip of snout to origin of dorsal 2.00–2.14, to origin of ventrals 2.16–2.45, to origin of anal 1.52–1.72 in standard length.

Dorsal I. 13–14, origin little behind ventrals and nearer to tip of snout than to base caudal, longest ray 1.24–1.34, base 2.04–2.52 in head. Anal 34–37, origin little behind or below end of dorsal, longest ray 1.63–1.90 in head, base 3.13–3.56 in standard length. Ventral 7, longest ray 2.01–2.07 in head. Pectoral 11–12, longest ray 1.40–1.68 in head.

Scales 40–42 in median lateral series to base of caudal, 10–11 transversely, 14–15 predorsal. Abdominal scutes 14–15+7–8.

Colouration: Back brown, silvery belly, scapular with black venules. Fins hyaline, dorsal and caudal dusky.

Described from 18 specimens 56.0–147.0 mm in total length, 44.5–116.0 mm in standard length, collected from Tamsui and Tainan.

Thrissa setirostris (Broussonet) Plate 2, Fig. 1.

Body elongate, compressed, dorsal profile as convex as the ventral. Snout bluntly rounded as little projecting, shorter than diameter of eye. Maxillary produced in a long filament, surpassing ventrals or sometimes to vent. Teeth in jaws, on vomer, palatines, pterygoids, tongue and one raw extend along maxillary edge. Lower gill-rakers 10–12, vertebrae 18–19+25–26.

Head 3.97–5.03, depth 3.47–4.54 in standard length. Snout 5.00–5.99, horizontal diameter of eye 3.68–4.49, postocular portion of head 1.69–1.89, height of head 1.10–1.52,

least depth of caudal peduncle 1.35–2.78, length of caudal 2.00–2.94 in head. Distance from tip of snout to origin of dorsal 1.90–2.01, to origin of ventral 2.28–2.45, to origin of anal 1.55–1.75 in standard length.

Dorsal I. 13–15, origin behind ventrals or in the midway between tip of snout and base of caudal, its longest ray 1.15–1.49, base 2.54 in head. Anal 35–39, origin below end of dorsal, longest ray 1.51–1.81 in head, its base 3.10–3.44 in standard length. Pectoral 12–14, longest ray 1.21–1.38 in head. Ventral 7, longest 2.00–2.54 in head.

Scales 40–44 in median lateral series, 10–11 transversely, 20–22 predorsal. Abdominal scutes 16–18+8–9.

Color silvery below, brownish gray above, scapular with black venules. Fins hyaline, sometimes dorsal blackish.

Described from 14 specimens, 44.0–167.0 mm in total length, 35.0–137.0 mm in standard length. Collected from Tamsui and Tainan.

Genus ENGRAULTS Cnvier

Engraulis japonicus Schlegel. Plate 2, Fig. 2.

Body elongate, cylindrical, a little compressed, dorsal profile about as straight as the ventral. Snout very prominent and pointed. Mouth large, maxillary ending a little behind mandibular joint. Teeth small in jaws, on vomer, palatines, pterygoids, but larger extend along maxillary edge. Lower gill-rakers 25–38. Vertebrae 22–26+ 18–21.

Head 3.25–3.82, depth 5.10–6.78 in standard length. Snout 4.08–5.80, horizontal diameter of eye 3.38–4.55, postocular portion of head 1.64–1.91, heigh of head 1.61–2.57, least deptn of caudal peduncle 2.62–4.32, length of caudal peduncle 1.24–2.19 in head. Distance from the tip of snout to origin of dorsal 1.73–2.09, to origin of ventral 1.96–2.54, to origin of anal 1.34–1.76 in standard length.

Dorsal 14–16, origin behind origin of ventral, or nearer to the tip of snout than to base of caudal, longest ray 1.62–2.36, base 1.95–2.52 in head. Anal 16–19, origin far behind end of dorsal, longest ray 2.27–3.63, its base 1.57–2.23 in bead. Pectoral 15–17, longest ray 1.86–2.82 in head. Ventral 7, longest ray 2.00–3.62 in head.

Scales 39–41 in median lateral series to base of caudal, 8 transversely, 20–21 predorsal, thin, very deciduous, no abdominl sutes.

Color brown on the back and the upper surface of head till to tip of snout, lower surface of body silvere white. Sometimes, silvery lateral band present in young stage. Dorsal brownish, caudal dusky or blackish, lower fins whitish.

Described from 155 specimens, 39.0–164.0 mm in total, 31.0–137.0 mm in standard length. Collected from Keelung, Taimsui, Tainan, Kaohsiung and Pescadore Islands.

According to Jordan and Seale the species is known by the subcylindrical from the absence of a silvery lateral stripe and ventral scutes, and more positively by the feeble skeleton, the rather dark, oily flesh, and by the relatively large mumber of vertebrae (46), and gill-rakers (38). But the species found in Taiwan as mentioned

above is different in number of vertebrae 22–26+18–21, gill-rakers 25–38 and presence of silvery lateral stripe in young stage, all of these vary from different growth-stage.

Genus STOLEPHORUS Lacepede

KEY TO SPECIES

A_1 Origin of anal at least behind end of dorsal.
  a_1 Anal far behind end of dorsal, anal 15–16. Maxillary reaching mandibular joint. vertebrae 23–25+18 ..... *S. zollingeri.*
  a_2 Anal just behind end of dorsal, anal 17–20. Maxillary reaching front border of preoperculum.
  Vertebrae 21–23+19–20 ..... *S. pseudoheterolobus.*
A_2 Origin of anal below dorsal,
  b_1 Dorsal with a free spine, median lateral series scales 32–35 ..... *S. tri.*
  b_2 Dorsal without a free spine, median lateral series scales 36–42..
    c_1 Median lateral series seales 38–40 ..... *S. indicus.*
    c_2 Median lateral series 36–38.
      d_1 Dorsal 16, anal 18. Vertebrae 20+20 ..... *S. iusularis.*
      d_2 Dorsal 13–15, anal 19–21. Vertebrae 21–22+18–19 ..... *S. commersonii.*

Stolephorus zollingeri (Blkr.) Plate 2, Fig. 3.

Body elongate, cylindrical, ventral profile more convex than dorsal. Snout a little prominent, shorter than eye. Maxillary reaches to mandibular joint, dilated posteriorly, rounded. Teeth small in jaws, on vomer, palatines, pterygoids, but larger extend along maxillary edge. Lower gill-rakers 22–26, longest 4.80–5.67 in head. Vertebrae 23–25+18.

Head 4.03–4.90, depth 5.31–6.50 in stadard lengtn. Snout 4.60–5.73, horizontal diameter of eye 3.00–3.90, postocular portion of head 1.57–2.33, height of head 1.37–1.92, least depth of caudal peduncle 2.28–3.40, length of caudal peduncle 1.00–1.59 in head. Distance from the tip of snout to origin of dorsal 1.82–2.18, to origin of ventral 2.07–2.58, to origin of anal 1.43–1.88 in standard length.

Dorsal 13–15, origin behind origin of ventral, midway between the tip of snout and first ray of caudal, its longest ray 1.29–1.88, base 1.37–2.33 in head. Anal 15–16, origin far behind end of dorsal, longest ray 1.60–2.87, base 1.22–1.89 in head. Pectoral 14–16, longest 1.47–1.95 in head. Ventral 7, longest ray 2.00–3.67 in head.

Scales deciduous, 39–41 in median lateral series, 8–9 transversely, 18–20 predorsal. Abdominal scutes 3–7.

Brown color on the back, silvery below, a silvery lateral band on the sides. A black spot on occiput. Fins lower hyaline, dorsal and caudal powdered with black.

Described from 164 specimens 47.0–108.3 mm in total length, 39.0–91.8 mm in standard length. Collected from Keelung, Badoz, Tamsui and Pescadore Islands.

Stolephorus pseudoheterolobus Hardenberg Plate 2, Fig. 4.

Body elongated and compressed. Dorsal profile as convex as ventral. Snont very prominent and pointed. Maxillary reaches to front of preopercnlnm, dilated posteriorly, truncated. Teeth in jaws, on vomer, tongue. palatines, pterygoids, but larger extend along maxillary edge. Lower gill-rakers 21–25, longest 4.37–5.80 in head. Vertebrae 21–23+19–20.

Head 3.60–4.18, depth 5.45–6.33 in standard length. Snout 4.21–4.87, horizontal diameter of eye 3.33–4.10, postocular portion of head 1.80–2.05, height of head 1.77–2.22, least depth of caudal peduncle 2.42–3·36, length of coudal peduncle 1.42–1.70 in head. Distance from tip of snout to origin of dorsal 1.84–1.95, to origin of ventral 2.00–2.45, to origin of anal 1.52–1.61 in standard length.

Dorsal 13–15, origin a little behind origin of ventral, or midway between tip of snout and base of caudal, its longest ray 1.45–1.79, base 2.02–2.56 in head. Anal 17–20, origin below or a little behind end of dorsal, its base 1.36–1.80, longest ray 2.19–2.56 in head. Pectoral 13–14, longest ray 1.71–2.32 in head. Ventral 7, longest ray 2.77–3.83 in head.

Scales deciduous, 38–42 in median lateral series, 9 transversely. Abdominal scutes 4–6.

Color grayish on the back, yellowish below, a silvery lateral band on the sides. A black spot on occiput. Lower fins hyaline, dorsal and caudal powdered with black.

Described from 35 specimens 54.9–101.0 mm in total length, 46.0–83.8 mm in standard length. Collected from Tamsui and Pescadore Islands.

Stolephorus tri (Blkr.) Plate 3, Fig. 1.

Body oblong, compressed, dorsal profile about as convex as the ventral. Snout prominent and blunt, shorter than eve. Maxillary dilated above mandibular joint, pointed, reaches to gill-opening. Teeth in jaws, on palatines, pterygoids and larger extend along maxillary edge, but non on vomer. Lower gill-rakers 22–26, longest 3.30–4.58 in head. Vertebrae 19+20.

Head 4.13–4.78, depth 4.52–5.91 in standard length. Snout 4.72–5.28, horizontal diameter of eye 2.74–3.55, postocular portion of head 2.00–2.05, height of head 1.34–1.71, least depth of caudal peduncle 1.20–1.49 in head. Discance from tip of snout to origin of dorsal 1.46–1.94, to origin of ventral 2.12–2.36, to origin of anal 1.60–1.93 in standard length.

Dorsal I. 14–17, origin nearer to caudal or midway between fore margin of eye and base of caudal, its base 1.41–1.95, longest ray 1.34–1.57 in head. Anal 19–21, longest ray 1.55–1.93 in head. Pectoral 11–13, longest ray 1.60–1.84 in head. Ventral 7, longest ray 2.24–3.17 in head.

Scales deciduous, 33–35 in median lateral series, 9 transversely, 18–21 predorsal. Abdominal scutes 4–7.

Color yellowish on the back and belly, a silvery lateral band along the sides, a black spot on occiput. Fins hyaline, caudal powdered with black.

Described from 16 specimens 59.0–76.0 mm in total length, 49.0–63.0 mm in standard length. Collected from Tamsui.

Stolephorus indicus (V. Hass.) Plate 3, Fig. 2.

Body elongated compressed, ventral profile more convex than the dorsal. Snout bluntly rounded, prominent, shorter than eye. Maxillary broadend above mandibular joint, pointed, reaches to gill-opening. Teeth in jaws, on vomer palatines, pterygoids, but larger and extend along maxillary edge. Lower gill-rakers 24–25, longest 4.40–4.87 in head. Vertebrae 20+19.

Head 4.00–4.32, depth 4.54–5.26 in standard length. Snout 3.70–4.44, horizontal diameter of eye 3.63–3.70, postocular portion of head 1.90–2.26, height of head 1.81–1.85, least depth of caudal peduncle 1.41–1.42 in head. Distance from tip of snout to origin of dorsal 1.88–192, to origin of ventral 2.21–2.22, to origin of anal 1.56–1.63 in standard length.

Dorsal 14, origin behind origin of ventrals, nearer to base of caudal than to tip of snout, its base 1.51, longest ray 1.40 in head. Anal 20–24, origin below 10th ray of dorsal, its base 1.23–1.36, longest ray 1.81 in head. Pectoral 13, longest 1.75–1.85 in head. Ventral 7, longest 2.10–2.22 in head.

Scales deciduous, 38–39 in median lateral series, 8–9 transversely, 19–20 predorsal. Abdominal scutes 4–5.

Color yellowish on the back, silvery below, a silvery lateral band on the sides, a black spot on occiput. Fins hyaline, but dorsally and caudally powdered with black.

Described from 2 specimens 96.0 and 99.0 mm in total length, 80.0 and 82·0 mm in standard length. Collected from Tamsui and Pescadore Islands.

Stolephorus insularis Hardenberg Plate 3, Fig. 3.

Body elongated, a little compressed. Dorsal profile about as equally convex as ventral. Snout prominent, bluntly reunded, shorter than eye, about 4/5 in eye. Maxillary dilated above mandibular joint, truncated, reaches to front border of preoperculum. Teeth in jaws, on vomer, palatines, pterygoids and extend along maxillary edge. Lower gill-rakers 23, longest 4.92–5.86 in head. Vertebrae 20+20.

Head 4.29–4.46, depth 5.17–5.86 in standard length. Snout 4.56–5.18, horizontal diameter of eye 3.35–3.58, postocular portion of head 1.89–2.03, height of head 1.81–2.19, least depth of caudal peduncle 3.06–3.24, length of caudal peduncle 1.01–1.21 in head. Distance from tip of snout to origin of dorsal 1.79–1.84, to origin of ventral 2.24–2.34, to origin of anal 1.56–1.61 in standard length.

Dorsal 16, origin behind ventral, nearer to base of caudal than to tip of snout or midway between fore margin of eye to base of caudal, its base 1.62–1.71, longest ray 1.63–1.78, in head. Anal 18, origin below 10–12th ray of dorsal, its base 1.29–1.48, longest ray 1.95–2.28 in head. Pectoral 14, longest 1.86–2.07 in head. Ventral 7, longest 2.76–2.93 in head.

Scales deciduous, 36–38 in median lateral series, 9–10 transversely, 18–19 predorsol.

Abdominal scutes 4–5.

Color grayish on the back, silvery below. A silvery lateral band on the sides. A black spot on occiput. Fins hyaline, but dorsally and caudally powdered with black.

Described from 5 specimens 105.0–111.0 mm in total length, 84.5–88.7 mm in standard length. Collected from Pescadore Islands.

Stolephorus commersonii Lacepede. Plate 3, Fig. 4.

Body elongated, compressed, dorsal profile about as equally convex as ventral. Snout bluntly rounded, shorter than eye. Maxillary broadened above mandibular joint, pointed, reaches to gill-opening. Teeth in jaws, on vomer, palatines, pterygoids and extend along maxillary edge. Lower gill-rakers 20–25, longest 3.60–4.83 in head. Vertebrae 21–22+18–19.

Head 3.64–4.31, depth 4.10–5.85 in standard length. Height of head 2.00–2.81, post-ocular portion of head 1.44–2.08, least depth of caudal peduncle 2.04–2.90, length of caudal peduncle 1.22–1.83 in head. Distance from tip of snout to origin of dorsal 1.69–1.96, to origin of ventral 2.05–2.41, to origin of anal 1.49–1.73 in standard length.

Dorsal 13–15, origin behind ventral, nearer to base of caudal than to tip of snout, its base 1.40–1.88, longest ray 1.20–1.92 in head. Anal 19–21, origin below dorsal, its base 1.08–1.64, longest ray 1.54–2.04 in head. Pectoral 12–15, longest ray 1.40–2.07 in head. Ventral 7, longest ray 1.79–2.90 in head.

Scales deciduous, 36–38 in median lateral series, 8–9 transversely. Abdominal scutes 3–4.

Color grayish on the back, silvery below, a silvery lateral band on the sides, a black spot on occiput. Fins hyaline, but dorsally and caudally powdered with black.

Described from 22 specimens 47.0–76.0 mm in total length, 39.4–59.5 mm in standard length. Collected from Tung-kong.

Most important Taxonomic characters of Twelve Species

Characters / Species	Vertebrae	Gill-rakers	Abdominal-scutes	Dorsal fin	Free dorsal spine	Anal fin	Silvery lateral band	Maxillary	Origin of anal
Setipinna taty		16–17	17–19+7–8	I. 13–14	Present	56	abscent	a little beyond mandibulary joint	below dorsal
Thrissa kammalensis	18–19+21–22	28–32	15–16+8–9	I. 13–14	Present	29–34	abscent	above mandibulary joint	behind end of dorsal
T. dussumieri	17–18+23–24	17–18	14–15+7–8	I. 13–14	Present	34–37	abscent	reaches nearly to ventral	below or behind end of dorsal
T. setirostris	18–19+25–26	10–12	16–18+8–9	I. 13–15	Present	35–39	abscent	surpassing ventral or to vent	below end of dorsal
Engraulis japonicus	22–26+18–21	25–38	abscent	14–16	abscent	16–19	Present in young stage	a little behind mandibulary joint	far behind end of dorsal
Stolephorus zollingeri	23–25+18	22–26	3–7	13–15	abscent	15–16	Ppesent	mandibular joint	far behind end of dorsal
S. pseudoheterolobus	21–23+19–20	21–25	4–6	13–15	abscent	17–20	Present	front border of preoperculum	below or little behind end of dorsal
S. tri	19–20+19–20	22–26	4–7	I. 14–17	Present	19–21	Present	mandibulary joint	below dorsal
S. indicus	20+19	24–25	4–5	14	abscent or Present	20–24	Present	mandibulary joint	below dorsal
S. insularis	20+20	23	4–5	16	abscent	18	Present	mandibulary joint	below dorsal
T. hamiltoni	20–21+24–25	13–15	17–19+10–11	I. 12–14	Present	36–42	abscent	little beyond gill-opening	below or behind end of dorsal
S. commersonii	21–22+18–19	20–25	3–4	13–15	abscent	19–21	Present	mandibulary joint	below dorsal

Plate 1

Fig. 1. Setipinna taty (C. V.)

Fig. 2. Thrissa kammalensis (Blkr.)

Fig. 3. Thrissa hamiltoni (Gray)

Fig. 4. Thrissa dussumieri (Valenciennes)

Plate 2

Fig. 1. Thrissa setirostris (Broussonet)

Fig. 2. Engraulis japonicus Schlegel.

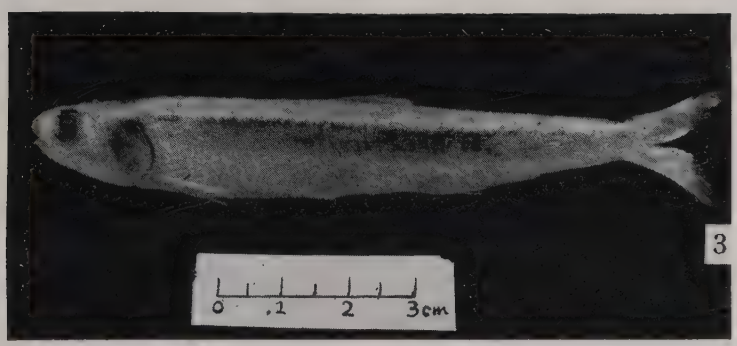

Fig 3. Stolephorus zollingeri (Blkr.)

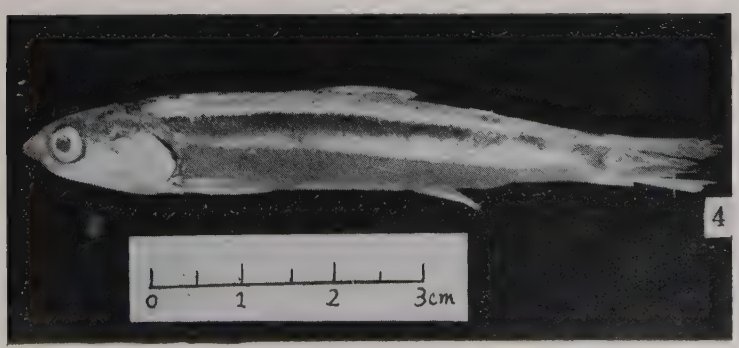

Fig. 4. Stolephorus pseudoheterolobus Hardenberg.

Plate 3

Fig. 1. Stolephorus tri (Blkr.)

Fig. 2. Stolephorus indicus (V. Hass.)

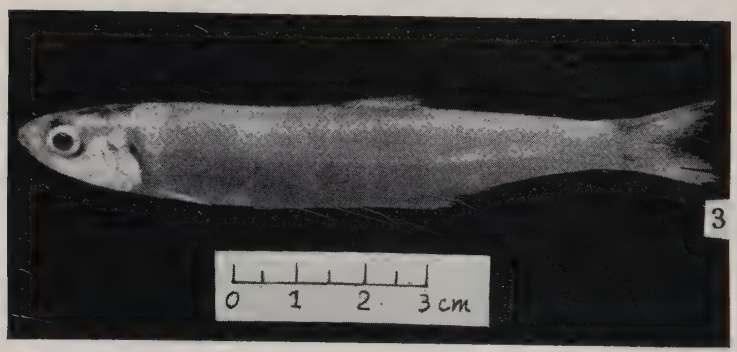

Fig. 3. Stolephorus insularis Hardenberg.

Fig. 4. Stolephorus commersonii Lacepede

摘　　要

沈　世　傑

鰹魚爲臺灣最重要之海產魚類，然種類繁多，不易分辨，茲特依據 1955 至 1958 年在基隆八斗子、淡水、臺南、高雄、東港及澎湖所採之標本計十二種作分類之考定，藉使減少研究此等魚類者之困難，在此十二種中，有五種爲以往臺灣無記錄者。

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NOTE ON THE FOOD HABIT OF LIZARD FISH (SAURIDA TUMBIL BLOCH) OF TAIWAN STRAITS.

By

TUNG IH-HSIU

The food habit of lizard fish of the East and Yellow Seas of China has been reported by R. Okada and K. Kyushin (3). What they have paid attention to are: a. The food habit in relation to diffenent sea regions and b. The food habit in relation to body length of the fish. The lizard fish of Taiwan Strait may be a stock different from that reported. It seems necessary to make a further study on the food habit of this fish especially on the points other than that mentioned above. Based upon the date collected during the whole year of 1955 and from January to october, 1956 the following points have been investigated:

1. The variety of food staffs and its seasonal variations.

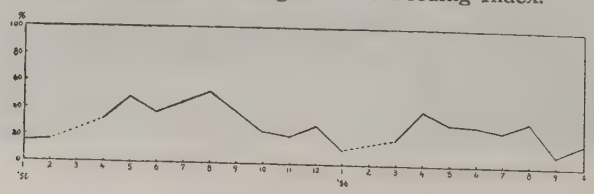
The lizard fish as noticed from the teeth arrangements in its mouth are predacious animals. They are greedy because more than 18% of the specimens possesses stomach contents which weigh 18% of its body weight and some 38% of the body weight. Many of the specimens have their stomach contents semidigested and thus made unrecognizable. The animals identified from the undigested stomach content are listed in table 1. It is found that the main food of this fish is composed of Acropoma japonicum, anchovies, shrimp and the larva and fry of its own, the white croakers, ribon fish, horse mackerel, red mullet, squid, cattle-fish etc., and mostly the Acropoma japonicum. The shrimp and the larvae and fry of squid and cattle fish composing 9.1–12.3% of the total stomach contents of the specimens examined. It can be seen also from Table 1 that variaty of food tends to vary with diffenent seasons of the year in the following manner: a. From April to July, the spawning season, the food is mainly composed of Acropoma japonicum, b. In other months, it is mostly composed of squid, cattle fish shrimp and fish larvae or fry of various fishes, especially the fry of the lizard fish itself.

2. Seasonal changes of the feeding index.

If we take the percent of specimens with stomach contents (number of specimens with stomach content/total number of specimens×100) as the feeding index which is found to vary with diffecent seasons. This is indicated in figure 1 in which it is

第一圖 捕食率之季節變化

Fig. 1 Seasonal Changes of the Feeding Index.



第一表　食性之季節變化

Table 1. Seasonal Changes of Stomach Contents.

魚種 Kind of Food ＼ 數量 No. 月份 Month	1955												1956										合計 Total	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	數量 No.	%
螢魚 Acropoma japonicum	—	—	—	4	12	—	3	—	—	1	1	—	—	—	—	4	4	2	—	—	—	—	31	12.3
蝦 Shrimp	—	1	—	2	3	3	4	1	—	1	1	2	—	—	—	1	—	—	—	1	—	1	29	11.5
尤魚 Squid	—	—	—	—	—	6	2	3	6	—	2	1	1	—	—	1	—	—	—	1	—	1	25	9.9
烏賊 Cuttle-fish	2	2	—	—	1	—	—	—	—	2	—	5	—	—	—	—	1	2	—	—	—	1	23	9.1
白口 White croaker	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14	5.6
狗母 Lizard-fish	—	—	—	—	1	4	1	—	1	1	2	—	—	—	—	—	—	—	1	1	—	—	14	5.6
白帶 Hair-tail	1	—	—	2	2	—	—	1	—	—	—	—	—	—	1	—	1	—	—	—	—	—	11	4.4
鰺 Horse-mackerel	—	—	—	—	—	1	1	4	—	—	—	—	—	—	—	—	1	—	—	—	—	—	10	4.0
鰛 Sardine	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	2.0
秋姑 Red-mullet	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	1	—	—	—	1	—	—	4	1.6
牛尾魚 Flathead-fish	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	
扁魚 Flat-fish	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	
紅目鱸 Big-eyes	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1	—	2	
金梭魚 Barracudas	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	
紅簾魚 Band-fish	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	4.4
皮刀 Moon-fish	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	
鯛 Sea-bream	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	
鯷仔 Anchovy	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	
不明 Obscurity	3	2	—	1	—	3	6	8	6	2	2	1	2	—	1	1	1	1	—	1	—	—	75	29.8
合計 Total	8	5	—	9	23	20	18	17	18	8	8	9	3	—	3	8	8	5	1	5	1	3	252	100

clearly seen that the fieding index is high during months between April and August or September and low in other months. This is shown in regular rhythmical manner in both years. The months during which the feeding index is high are the months when spawning takes place or immediately after spawning.

3. The feeding index in relation with the stage of maturity.

Table 2 shows the feeding index which has relation with the stage of maturity of fish. In both sex, the fish of stage A have the lowest feeding index and in other stages it is all high. This phenomena proves that the seasonal variation of feeding index discussed in the preceeding paragraph is true because mature fish and the spent fish eat more. The femals seem to eat more than the male and especially the spent females possess the highest feeding index.

4. Distribution of stomach contents in different sexes.

Table 3 shows the kinds of food taken by different sexes of fish at different stages of maturity. It is found that the food habit of both sexes is almost the same at stage A, but the males at stages B and C seem to eat more Acropoma japonicum and shrimp than the females do. At stage D, the food of females is chiefly composed of anchovies while that of the males is composed mostly of shrimp and larvae of fishes. This may indicats that the male and female have a different pattern of distribution.

The present observation shows that the food habit of the lizard fish investigated is in some way different from that reported by Okada and Kyushin (3), so these lizard fish may be a different stock or race in comparason with that inhabit in the nowthern East Sea. Moreover, the feeding index of these fish could be used to justify the spwaning season.

第二表　捕食率與成熟度

Table 2. Feeding Index in Relation with Maturity.

	成熟度 Maturity	資料數 No. of Sample	捕食尾數 No, of Fish with Stomach Content	捕食率% Index of Feeding
♀	A	185	54	29
	B	26	9	35
	C	9	3	33
	D	14	6	43
	合計 Total	234	72	31
♂	A	204	56	27
	B	61	18	30
	C	27	6	22
	D	20	6	30
	合計 Total	312	86	28

第三表　雌雄性與食性

Table 3. Distribution of Stomach Contents in Different Sexes.

魚種 Kind of Food ＼ 數量 No. 成熟度 Maturity	♀ A	♀ B	♀ C	♀ D	♂ A	♂ B	♂ C	♂ D
螢魚 Acropoma japonicum	10	1	1	1	6	7	5	—
蝦 Shrimp	4	—	—	—	10	4	2	1
尤魚 Squid	9	—	—	—	10	—	—	1
烏賊 Cuttle-fish	3	1	1	—	5	3	—	—
白口 White-croaker	—	—	—	—	—	—	—	2
狗母 Lizard-fish	4	—	—	—	7	2	—	1
白帶 Hair-tail	1	2	1	1	—	1	1	—
鯵 Horse-mackerel	3	1	—	—	3	—	—	—
鰮 Sardine	1	—	—	3	—	—	—	1
其他 Other	21	5	1	1	18	4	—	2
合計 Total	56	10	4	6	59	21	8	8

摘　　要

童　逸　修

東海狗母魚之食物習性，岡田立三郎及久新健一郎，曾作觀察，惟僅注意其對於體長與分佈之關係，本文對於其與季節之關係，與性別關係均加分析，查其捕食率最高季節，恰爲產卵季節前後，得悉此魚之捕食率可以用作決定產卵季節，又所觀察之狗母習性與在東海北部所產者略有不同，故海峽方面之狗母可能與東海北部者之族羣不同。

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APPENDIX

捕食率之季節變化

Seasonal Changes of the Feeding Index.

月份 Month	1955											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
資料數 No. of Sample	56	34		26	46	50	39	33	37	26	40	40
捕食尾數 No. of Fish with Stomach Content	8	5		8	22	18	17	17	14	6	8	11
捕食率 % Index of Feeding	14.3	14.7		30.8	47.8	36.0	43.6	51.5	37.8	23.1	20.0	27.5

月份 Month	1956									
	I	II	III	IV	V	VI	VII	VIII	IX	X
資料數 No. of Sample	28		16	18	23	17	4	9	12	12
捕食尾數 No. of Fish with Stomach Content	3		3	7	7	5	1	3	1	2
捕食率 % Index of Feeding	10.7		18.8	38.9	30.4	29.4	25.0	33.3	8.3	16.7

A LIST OF EDIBLE MOLLUSKS OF TAIWAN

By

TONG-YUN HO

Mollusks are delicious food very fond of by the people of Taiwan. Edible mollusks are usually very expensive and consist of a great number of species. Taxonomical works on local mollusks had been done by Japanese prior to World War II yet no special attention had been paid to the edible spedies. The author has collected with special interest to the edible species, 26 species of Gastropoda, 42 species of Pelecypoda and 10 species of Cephalopoda which are all used ordinarily as food by the local people. A report has been prepared in Chinese together with text figures and plates and will be published in the local Chinese Journal. They are presented here in a list as follows:

1. Haliotidae

(1) *Haliotis japonica* (Reevv) Plate 1. Fig. 1
*Deist. Taipei Hsien; Keelung; Suao; Hualien; Penghu.

(2) *Haliotis asinina* (Linnaeus) Plate 1. Fig. 2
Dist. Penghu.

2. Cymatidae

(3) *Charonia tritonis* (Linnaeus) Plate 1. Fig. 3
Dist. Suao; Lutao; Penghu.

3. Muricidae

(4) *Thais luteostoma* (Dillwyn) Plate 1. Fig. 4
Dist. Taipei Hsien; Suao; Penghu; Lukang.

(5) *Thais javanica* (Philipi) Plate 1. Fig. 5
Dist. Lukang; Tainan Hsien

4. Strombidae

(6) *Strombus isabella* (Lamarck) Plate 1. Fig. 6
Dist. Keelung; Taipei Hsien; Penghu; Kaohsiung.

5. Fasciolaridae

(7) *Fusinus forceps* (Perry) Plate 1. Fig. 7
Dist. Penghu.

(8) **Fasciolaria trapezium** (Linnaeus) Plate 1. Fig. 8
Dist. Taipei Hsien; Suao; Hualien; Penghu.

6. Volutidae

(9) *Cymbium melo* (Solander) Plate 1. Fig. 9
Dist. Kaoshiung; Anping.

7. Tonnidae

(10) *Tonna lischkeann* (Küster) Plate 1. Fig. 10

* Dist.—distribution.

Dist. Anping; Kaohsiung.

(11) *Tonna perdix* (Linnaeus) Plate 1. Fig. 11
Dist. Hualien; Lutao; Hsiaoliuchiu; Penghu.

(12) *Tonna canaliculata* (Linnaeus) Plate 1. Fig. 12
Dist. Suao; Hsiaoliuchiu; Penghu.

(13) *Tonna olearium* (Linnaeus) Plate 1. Fig. 13
Dist. Hsiaoliuchiu; Kaohsiung; Penghu.

8. Viviparidae

(14) *Viviparus chinensis* (Griffith & Pidgeon) Plate 2. Fig. 14
Dist. Taipei; Sun Moon Lake.

9. Trochidae

(15) *Trochus sacellum* (Philippi) Plate 2. Fig. 15
Dist. Keelung; Taipei Hsien; Suao; Hualien; Hsiaoliuchiu; Penghu.

(16) *Trochus obelicus* (Gmelin) Plate 2. Fig. 16
Dist. Taipei Hsieni Hsinchu; Penghu; Lutao.

(17) *Trochus maculatus* (Linnaeus) Plate 2. Fig. 17
Dist. Taipei Hsien; Suao.

(18) *Monodonta labio* (Linnaeus) Plate 2. Fig. 18
Dist. Keelung; Taipei Hsien; Suao; Kaohsiung; Penghu.

10. Turbinidae

(19) *Turbo petholatus* (Linnaeus) Plate 2. Fig. 19
Dist. Kaohsiung.

(20) *Turbo marmoratus* (Linnaeus) Plate 2. Fig. 20
Dist. Keelung; Hualien; Lutao; Lan Yu; Hengchung; Hsiaoliuchiu.

(21) *Turbo chrysostomus* (Linnaeus) Plate 2. Fig. 21
Dist. Penghu; Hsioliuchiu.

(22) *Turbo articulatus* (Reeve) Plate 2. Fig. 22
Dist. Tansui; Penghu; Hsioliuchiu.

(23) *Turbo argyprostomus* (Linnaeus) Plate 2. Fig. 23
Dist. Hsiaoliuchiu.

(24) *Turbo setosus* (Gmelin) Plate 2. Fig. 24
Dist. Suao; Hualien.

(25) *Turbo sparverius* (Gmelin)
Dist. Kaohsiung.

(26) *Turbo stenogyrus* (Fisher) Plate 2. Fig. 26
Dist. Suao.

11. Pectinidae

(27) *Spondylus ducalis* (Bolten) Plate 3. Fig. 27
Dist. Distributing all over the island's coast.

(28) *Amusium pleuronectes* (Linnaeus) Plate 3. Fig. 28
Dist. Tainan Hsien; Kaohsiung; Penghu.

12. Pteridae

(29) *Pteria margaritifera* (Linnaeus) Plate 3. Fig. 29
Dist. Hualien; Kaohsiung; Penhu.

(30) *Pteria chemnitzii* (Philippi) Plate 3. Fig. 30
Dist. Distributing all over the island's coast.

13. Ostreidae

(31) *Ostrea gigas* (Thumberg) Plate 3. Fig. 31
Dist. Suao; Kaohsiung; Amping; Penghu; Lukang.

(32) *Ostrea laperousei* (Shrerck) Plate 3. Fig. 32
Dist. Kaohsiung.

(33) *Volsella trailli* (Reeve) Plate 4. Fig. 33
Dist. Keelung; Hsiaoliuchiu.

(34) *Volsell*a *metacalfei* (Hanleg) Plate 4. Fig. 34
Dist. Hsiangshan; Hsiangchu Hsien; Anping.

(35) *Lithophaga teres* (Philippi) Plate 4. Fig. 35
Dist. Penghu.

15. Arcidae

(36) *Anadara granosa* (Linnaeus) Plate 4. Fig. 36
Dist. Keelung; Anping; Penghu; Kaohsiung.

(37) *Anadara subcrenata* (Lischke) Plate 4. Fig. 37
Dist. Lukang.

(38) *Arca fusca* (Bruguiere) Plate 4. Fig. 38
Dist. Taipei Hsien; Suao; Hualien; Hsiaoliuchiu; Kaohsiung; Penghu.

16. Laternulidae

(39) *Laternula rastrata* (Sowerby) Plate 4. Fig. 39
Dist. Hualien; Kaohsiung; Tungkang.

17. Solenidae

(40) *Solen cf. sicarius* (Gould) Plate 4. Fig. 40
Dist. Hsinchu Hsien; Hsianshang; Lukang; Tainan Hsien.

18. Asphidae

(41) *Sanguinolaria violaceae* (Lamarck) Plate 4. Fig. 41
Dist. Taipei Hsien; Lukang; Tungkand; Kaohsiung.

(42) *Sanguinolaria ambigur*a (Reeve) Plate 4. Fig. 42
Dist. Lukang; Penghu.

(43) *Sanguinolaria adamsii* (Reeve) Plate 4. Fig. 43
Dist. Anping; Penghu; Kaohsiung; Tungkang.

(44) *Sanguinolaria planulata* (Reeve) Plate 4. Fig. 44
Dist. Wuhsi; Anping; Penghu.

(45) *Sanguinolaria rostrata* (Solander) Plate 4. Fig. 45
Dist. Anping; Kaohsiung.

19. Veneridae

(46) *Mactra veneriformis* (Reeve) Plate 5. Fig. 46

Dist. Taipei Hsien; Lukang.

(47) *Meretrix lamarckii* (Deshayes) Plate 5. Fig. 47

Dist. Tansui; Suao; Tainan Hsien.

(48) *Meretrix Lyrata* (Sowerby) Plate 5. Fig. 48

Dist. Tansui; Hualien; Anping.

(49) *Meretrix petechialis* (Lamarck) Plate 5. Fig. 49

Dist. Taipei Hsien; Tansui; Lukang; Kangsheng; Kaoshing.

(50) *Meretrix meretrix* (Linnaeus) Plate 5. Fig. 50

Dist. Tainan Hsien; Kaohsiung.

(51) *Meretrix lusoria formosana* (Sowerby) Plate 5. Fig. 51

Dist. Keelung; Tainan Hsien; Kaohsiung.

(52) *Gomphina undulosa* (Lamarck)

Dist. Ngolanpi.

(53) *Gomphina veneriformis* (Lamarck) Plate 5. Fig. 53

Dist. Tansui; Taipei Hsien; Lukang; Penghu.

(54) *Anomalocardia impressa* (Anton) Plate 5. Fig. 54

Dist. Hsinchu Hsien; Kangshang; Anping, Penghu; Kaohsiung.

(55) *Gafrarium tumidum* (Röding) Plate 5. Fig. 55

Dist. Taipei Hsien; Tainan Hsien; Penghu; Kaohsiung.

(56) *Venus reticulata* (Linnaeus) Plate 5. Fig. 56

Dist. Taipei Hsien; Suao; Hualien; Hsiaoliuchiu.

(57) *Cyclina sinensis* Gmelin Plate 6. Fig. 57

Dist. Taipei Hsien; Hsinchu Hsien; Lukang; Kangshang; Penghu.

(58) *Sunetta cumingii* (Smith) Plate 6. Fig. 58

Dist. Suao; Taipei Hsien; Tainan Hsien; Kaohsiung.

(59) *Chione squamosa* (Linnaeus) Plate 6. Fig. 59

Dist. Keelung; Hualien; Kaohsiung; Penghu; Kangshang; Anping.

(60) *Chione isabellina* (Philippi) Plate 6. Fig. 60

Dist. Keelung; Taipei Hsien; Tainan Hsien; Kaohsiung.

20. Crassatellidae

(61) *Crassatellites foveolatus* (Sowerby) Plate 6. Fig. 61

Dist. Taipei Hsien; Kaohsiung.

21. Tridachneidae

(62) *Tridachnes elongata* (Lamarck) Plate 6. Fig. 62

Dist. Taipei Hsien; Suao; Kaohsiung; Hsiaoliuchiu.

22. Corbiculidae

(63) *Corbicula flumina* (Müller) Plate 6. Fig. 63

Dist. Suao; Keelung; Taipei Hsien; Taichung Hsien; Tainan Hsien; Hsiaoliuchiu.

(64) *Corbicula formosana* (Dall) Plate 6. Fig. 64

Dist. Keelung river (Taipei); Tansui river; Tainan Hsien.

(65) *Corbicula maximum* (Prime) Plate 6. Fig. 65

Dist. Tansui River; Suao; Anping.

23. Unionidae

(66) *Anodonta woodiana* (Ler) Plate 6. Fig. 66

Dist. Taipei Hsien; Tansui; Sun Moon Lake; Tainan Hsien.

(67) *Cristaria discoidea sautteri* (Hass) Plate 6. Fig. 67

Dist. Miaoli Hsien; Taipei Hsien; Tainan Hsien; Kaohsiung Hsien; Suao; Taitung Hsien.

(68) *Unio douglasiae taiwanicus* (Pilsbry) Plate 6. Fig. 68

Dist. Taipei Hsien; Tainan Hsien; Kaohsiung Hsien; Hualien Hsien.

24. Octopodidae

(69) *Octopus vulgaris* (Lamarck) Plate 7. Fig. 69

Dist. Keelung.

25. Loliginidae

(70) *Loligo edulis* (Hoyle) Plate 7. Fig. 70

Dist. Keelung.

(71) *Loligo formosana* (Sasaki) Plate 7. Fig. 71

Dist. North coast; West coast.

(72) *Loligo oshimai* (Sasaki) Plate 7. Fig. 72

Dist. North coast; South coast.

(73) *Sepioteuthis lessoniana* (Ferussae) Plate 7. Fig. 73

Dist. West coast of Tainan Hsien.

26. Sepiolidae

(74) *Euprymna morsei* (Verrill) Plate 7. Fig. 74

Dist. West coast of Tainan Hsien.

27. Sepiidae

(75) *Sepia formosana* (Berry) Plate 8. Fig. 75

Dist. South-west coast.

(76) *Sepia tigris* (Sasaki) Plate 8. Fig. 76

Dist. Distribution of this species is unknown, but the specimens of this species were found at Taipei Market.

(77) *Sepia subaculeata* (Sasaki) Plate 8. Fig. 77

Dist. West coast of Tainan Hsien.

(78) *Sepia aculeata* (Van Hasselt) Plate 8. Fig. 78

摘　　要

何　通　雲

軟體動物爲本省（臺灣）人民嗜食之珍品，價值昂貴，種類繁多，以往日人對此類動物雖曾詳作報告，但均未注重食用方面，作者經一年來之採集調查，得悉臺灣人民所食者計有 Gastropods 26 種，Pelecypods 42 種，Cephalopods 10 種。

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圖 版 1

圖 1. *Haliotis japonica* (Reeve) (常節), $\times\frac{33}{47}$

圖 2. *Haliotis asinina* (Linnaeus) (耳貝), $\times\frac{7}{10}$

圖 3. *Charonia tritonis* (Linnaeus) (法螺), $\times\frac{16}{65}$

圖 4. *Thais luteostoma* (Dillwyn) (粟皮荔枝), $\times\frac{7}{10}$

圖 5. *Thais javanica* (Philippi) (灰荔枝), $\times\frac{17}{30}$

圖 6. *Strombus isabella* (Lamarck) (水晶貝), $\times\frac{1}{3}$

圖 7. *Fusinus forceps* (Perry) (絲卷長幸螺), $\times\frac{1}{3}$

圖 8. *Fasciolaria trapezium* (Linnaeus) (絲卷法螺), $\times\frac{5}{12}$

圖 9. *Cymbium melo* (Solander) (椰子貝), 日本動物圖鑑原圖 ×1

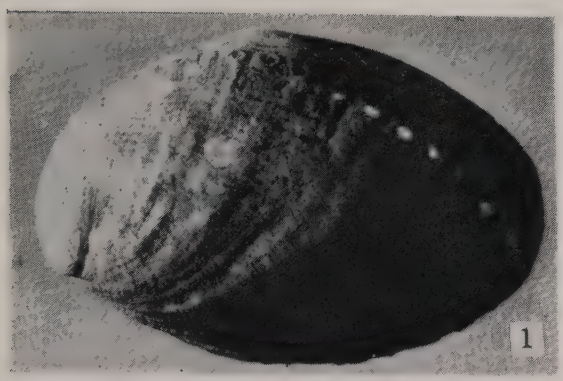
圖 10. *Tonna lischkeann* (Küster) (鶉形八代貝), $\times\frac{1}{3}$

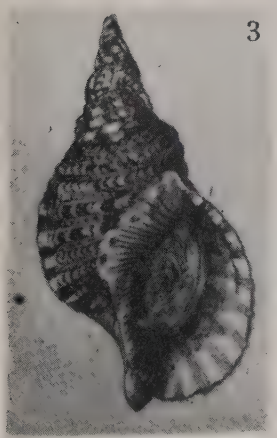
圖 11. *Tonna perdix* (Linnaeus) (鶉貝), $\times\frac{1}{7}$

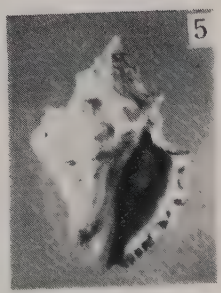
圖 12. *Tonna canaliculata* (Linnaeus) (竦鶉貝), $\times\frac{1}{3}$

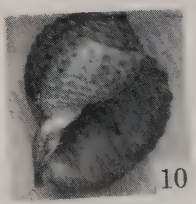
圖 13. *Tonna olearium* (Linnaeus) (條鶉貝), $\times\frac{1}{2}$

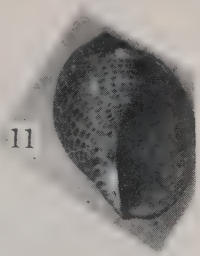
Explanation of plates

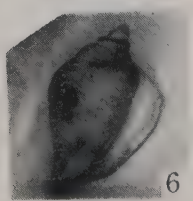


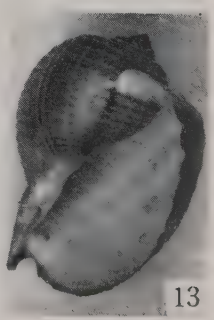












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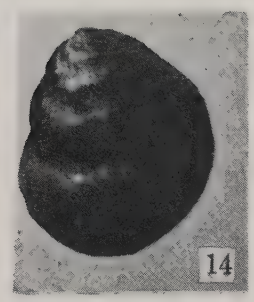
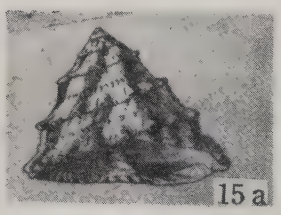
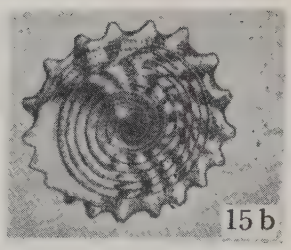
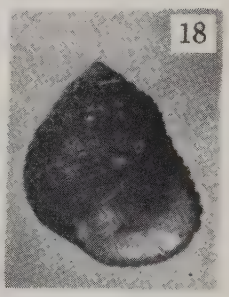
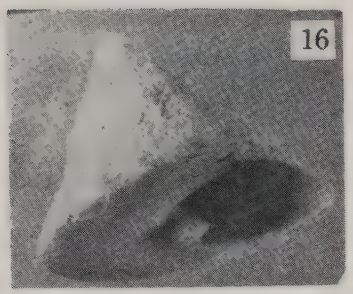
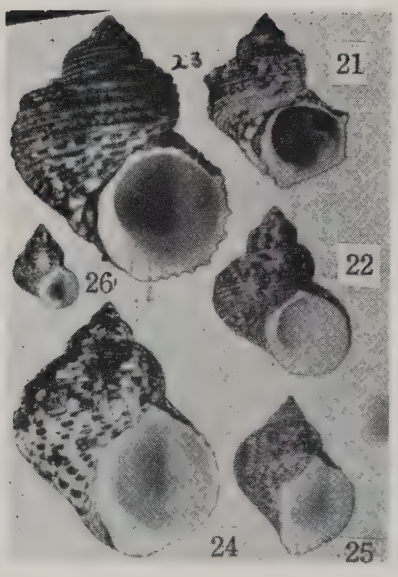












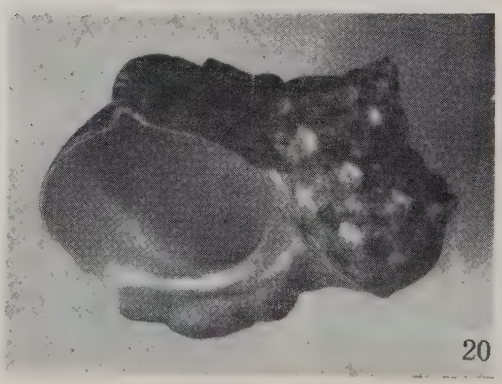


圖 版 2

圖 14. *Viviparus chinensis* (Griffith & Pidgeon) (田螺), $\times\frac{7}{10}$

圖 15a., 15b, *Trochus sacellum* (Philippi) (一字斑螺), 日本動物圖鑑原圖 $\times\frac{7}{8}$

圖 16. *Trochus obeliscus* (Gmelin) (銀斑螺), $\times\frac{7}{8}$

圖 17. *Trochus maculata* (Linnaeus) (錦斑螺), $\times\frac{16}{21}$

圖 18. *Monodonta labio* (Linnaeus) (石疊), $\times 1$

圖 19. *Turbo petholatus* (Linnaeus) (龍天), $\times\frac{1}{3}$

圖 20. *Turbo marmoratus* (Linnaeus) (夜光貝), $\times\frac{7}{8}$

圖 21. *Turbo chrysostomus*) (Linnaeus) (金口榮螺), 黑田原圖 $\times\frac{7}{10}$

圖 22. *Turbo articulatus* (Reeve) (大高腰榮螺), 黑田原圖 $\times\frac{7}{10}$

圖 23. *Turbo argyrostomus* (Linnaeus) (朝鮮榮螺), 黑田原圖 $\times\frac{7}{10}$

圖 24. *Turbo setosus* (Gmelin) (丸榮螺), 黑田原圖 $\times\frac{7}{10}$

圖 25. *Turbo spaverius* (Gmelin) (臺灣榮螺), 黑田原圖 $\times\frac{7}{10}$

圖 26. *Turbo stenogyrus* (Fishen) (高腰榮螺), $\times\frac{7}{10}$

圖 版 3

圖 27. *Spondylus ducalis* (Bolte) (面貝), $\times\frac{7}{10}$

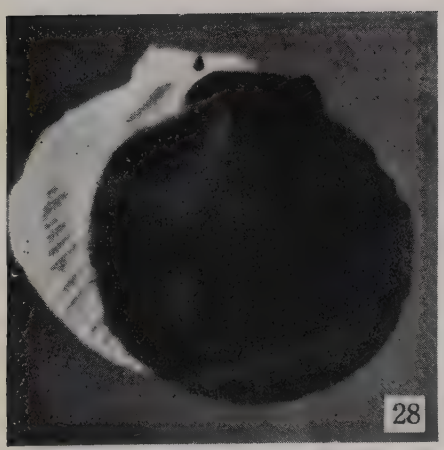
圖 28. *Amusium pleuronectes* (Linnaeus) (高山日月見), $\times\frac{17}{30}$

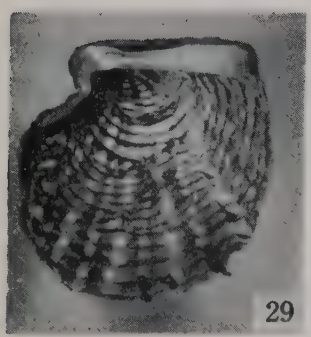
圖 29. *Pteria margaritifera* (Linnaeus) (黑蝶貝), $\times\frac{7}{13}$

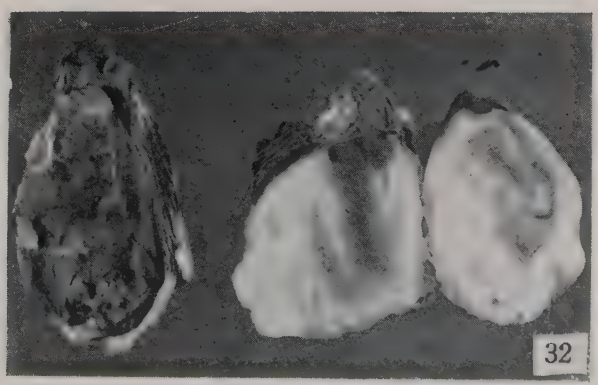
圖 30. *Pteria chemnitzii* (Philippi) (眞珠貝), $\times\frac{7}{10}$

圖 31. 32. *Ostrea gigas* (Thumberg) (長蠣厲), $\times\frac{7}{10}$

Explanation of plates







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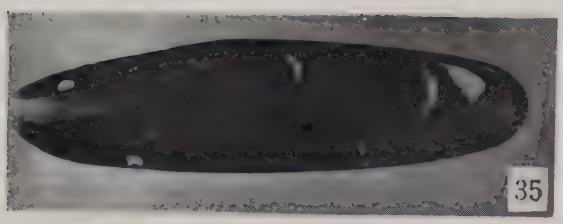
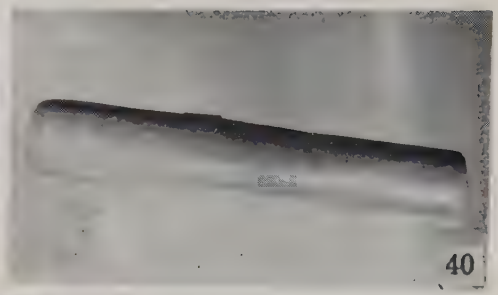
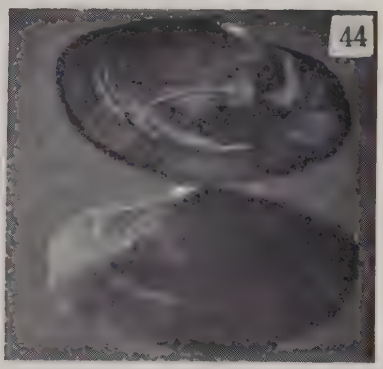
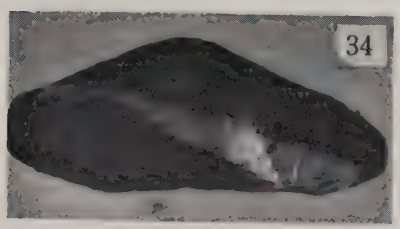
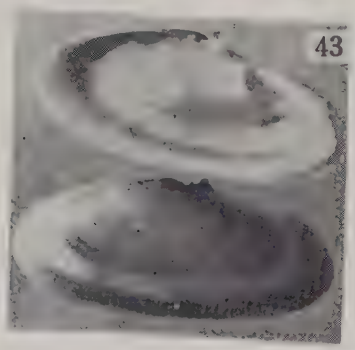
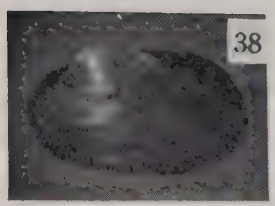


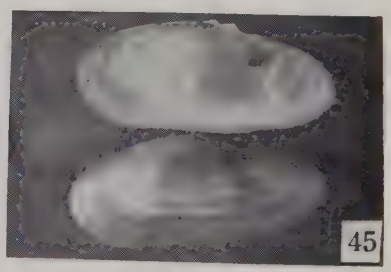


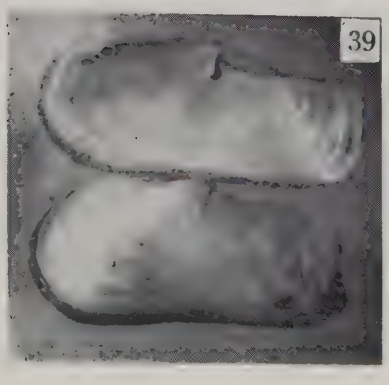












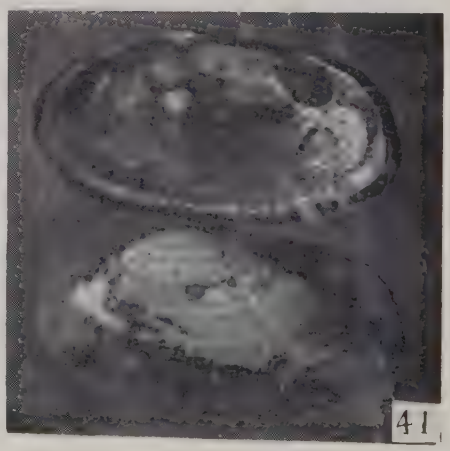


圖 版 4

圖 33. *Volsella trailli* (Reeve) (雲雀貝), ×1$\frac{1}{10}$

圖 34. *Volsella metacalfei* (Haneley) (苔烏貝), 日本動物圖鑑原圖 ×1

圖 35. *Lithophaga teres* (Philippi) (黑鴨嘴貝), ×1$\frac{1}{10}$

圖 36. *Anadara granosa* (Linnaeus) (灰蛤), ×$\frac{34}{45}$

圖 37. *Anadara suberenata* (Liscke) (猿頰貝), ×1$\frac{1}{10}$

圖 38. *Arca fusca* (Brugueier) (紅江貝), ×$\frac{4}{5}$

圖 39. *Laternula rostrata* (Sowerby) (廣口衣通貝), ×$\frac{4}{5}$

圖 40. *Solen of sicarius* (Gould) (臺灣大竹蟶), ×$\frac{15}{28}$

圖 41. *Sanguinolaria violaceae* (Lamarck) (朝顏眞蘇枋), ×$\frac{34}{45}$

圖 42. *Sanguinolaria ambigua* (Reeve) (臺灣眞蘇枋), ×1$\frac{1}{10}$

圖 43. *Sanguinolaria adamsii* (Reeve) (紫貝), ×$\frac{34}{45}$

圖 44. *Sanguinolaria planulata* (Reeve) (臺灣砧貝), ×$\frac{34}{45}$

圖 45. *Sanguinolaria rostrata* (Solander) (富士紫貝), ×$\frac{34}{45}$

圖 版 5

圖 46. *Mactra veneriformis* (Reeve) (潮吹), $\times\frac{4}{5}$

圖 47. *Meretrix lamarckii* (Deshayes) (朝鮮文蛤), $\times\frac{33}{47}$

圖 48. *Meretrix lyrata* (Sowerby) (簾文蛤), $\times\frac{34}{45}$

圖 49. *Meretrix petechialis* (Lamarck) (中國文蛤), $\times\frac{33}{47}$

圖 50. *Meretrix meretrix* (Linnaeus) (文蛤), $\times\frac{2}{3}$

圖 51. *Meretrix lusoria* formosa (Sowerby) (臺灣文蛤), $\times\frac{7}{10}$

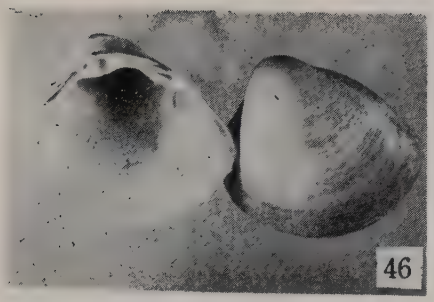
圖 53. *Gomphina veneriformis* (冲淺利), $\times\frac{34}{45}$

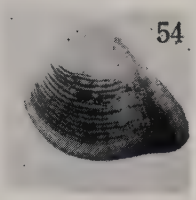
圖 54. *Anomalocardia impressa* (Anton) (高山鹽屋貝), 黑田原圖 $\times\frac{2}{3}$

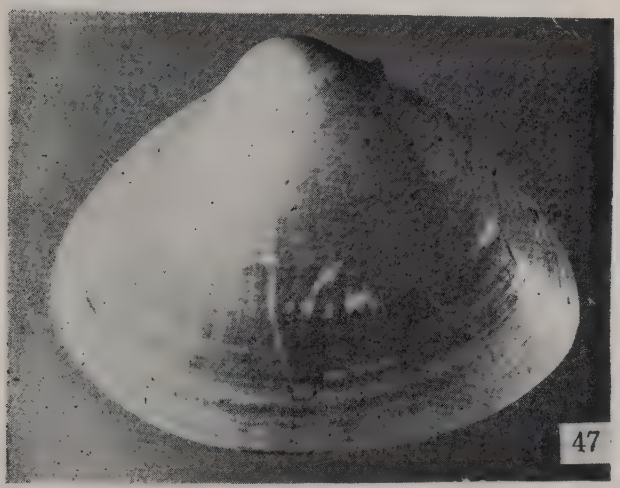
圖 55. *Grafrarium tumidum* (Röding) (印南貝), $\times\frac{4}{5}$

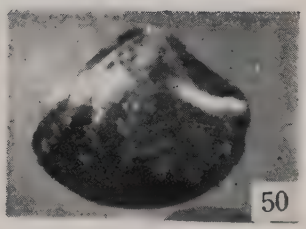
圖 56. *Venuo reticulata* (Linnaeus) (粗簾蛤), $\times\frac{2}{3}$

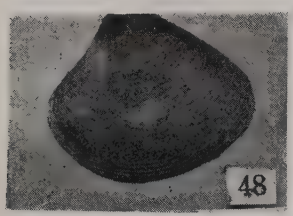
Explanation of plates

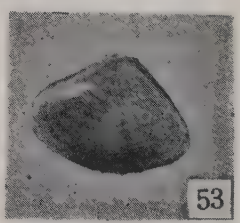


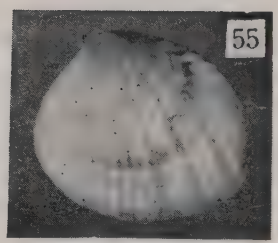




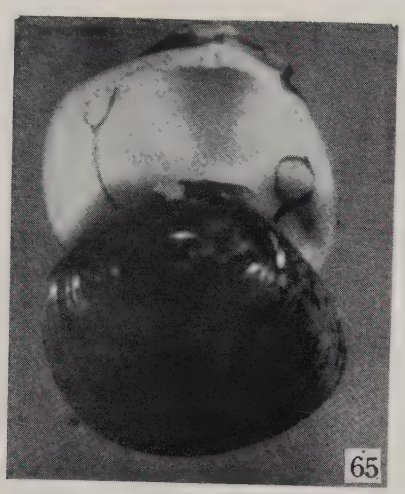


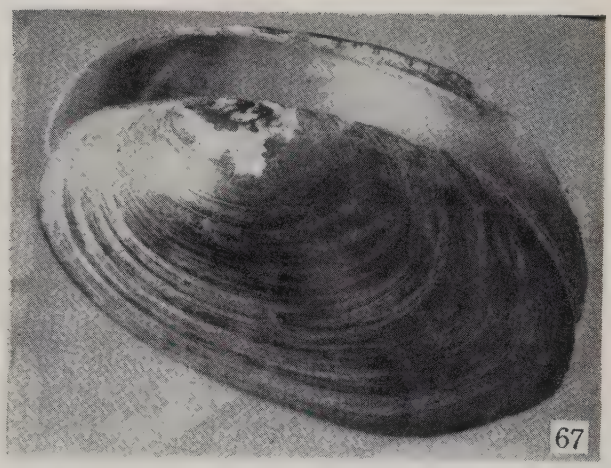


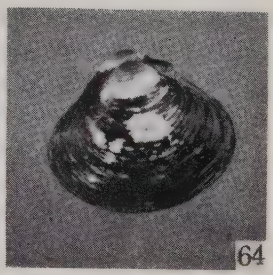


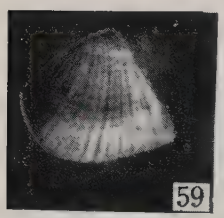


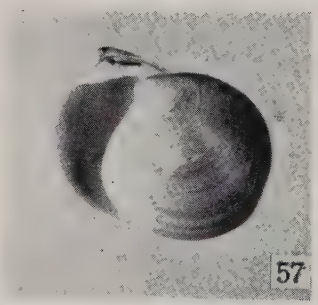
Explanation of plates

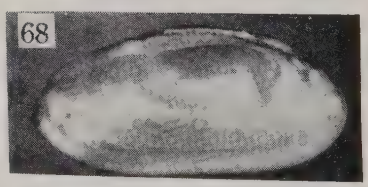


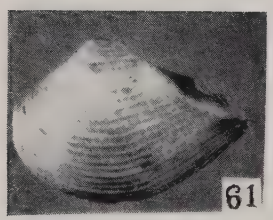


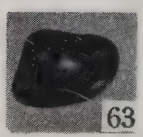












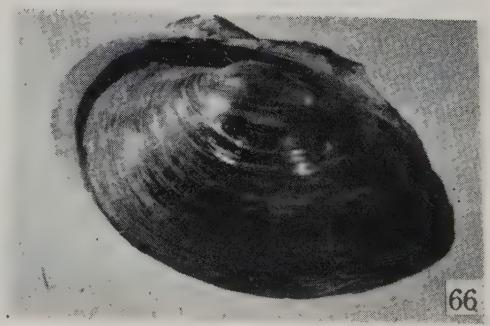


圖 版 6

圖 57. *Cyclina sinensis* Gmelin (冲蜆), $\times\frac{2}{5}$

圖 58. *Sunetta cumingii* (Smith) (臺灣志貝), $\times\frac{34}{45}$

圖 59. *Chione squamosa* (Linnaeus) (鹽屋貝), $\times 1\frac{1}{10}$

圖 60. *Chione isabelline* (Philippi) (大花貝), $\times\frac{4}{5}$

圖 61. *Crassatellites foveolatus* (Sowerby) (八管藻鹽貝), $\times\frac{4}{5}$

圖 62. *Tridachnes elongatus* (Lamarck) (長硨磲), $\times\frac{1}{2}$

圖 63. *Corbicula fluminea* (Müller) (臺灣蜆), $\times 1\frac{1}{10}$

圖 64. *Corbicula formosana* (Dall) (花蜆), $\times 1$

圖 65. *Corbicula maximum* ((Prime) (大蜆), $\times\frac{2}{3}$

圖 66. *Anodonta woodiana* (Ler) (臺灣田蚌), $\times\frac{2}{5}$

圖 67. *Cristaria discoidea sautteri* (Hass) (擬田蚌), $\times\frac{7}{8}$

圖 68. *Unio douglasiae taiwanicus* (Pilsbry) (臺灣池蚌), $\times\frac{34}{45}$

圖 版 7

圖 69. *Octopus vulgaris* (Lamarck (眞章魚), 佐佐木原圖 $\times\frac{1}{3}$

圖 70. *Loligo edulis* (Hoyle) (劍先烏賊), $\times\frac{1}{3}$

圖 71. *Loligo formosana* (Sasaki) (臺灣烏賊), 佐佐木原圖 $\times\frac{30}{31}$

圖 72. *Loligo oshimai* (Sasaki) (大島烏賊), $\times\frac{1}{2}$

圖 73. *Sepioteuthis lessoniana* (Férussac) (白烏賊), 佐佐木原圖 $\times\frac{1}{5}$

圖 74. *Euprymna morsei* Verrill (耳烏賊) $\times\frac{2}{3}$

Explanation of plates

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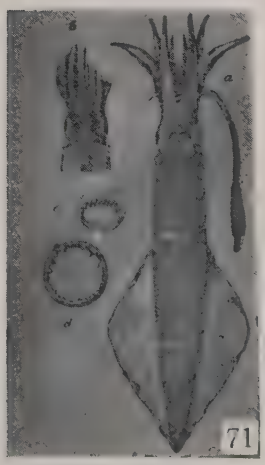
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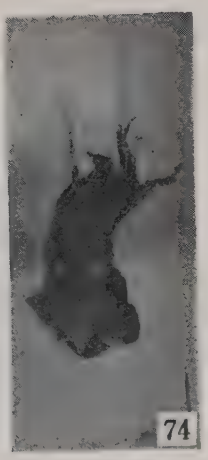
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Explanation of plates

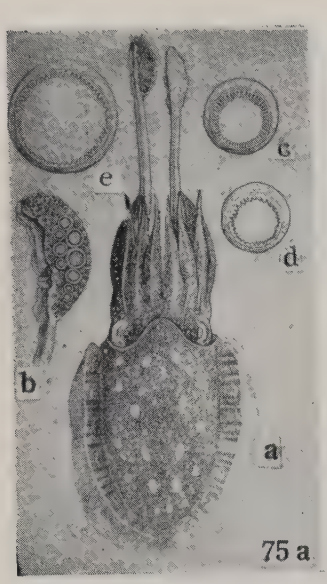

圖 版 8

圖 75. a. *Sepia formosana* (Berry) (臺灣甲烏賊), 佐佐木原圖 $\times \frac{14}{31}$; a 動物體背面, b. 觸腕頭, c. 觸腕之角質環, d. 第三脚腕之角質環, e. 觸腕之最大角質環.

圖 75. b. *Sepia formosana* Berry, 內介殼, 佐佐木原圖 $\times \frac{6}{11}$

圖 76. *Sepia tigris* (Sasaki) (虎皮甲烏賊), 佐佐木原圖 $\times \frac{5}{19}$

圖 77. a. *Sepia subaculeata* (Sasaki), 佐佐木原圖 $\times \frac{11}{35}$

圖 77. b. *Sepia subaculdata* (Sasaki) 之內介殼, 佐佐木原圖 $\times \frac{13}{23}$

圖 78. a. *Sepia aculeata* (Van Hasselt), 動物體背面與內介殼腹面, ×

圖 78. b. Sepia aculeata (Van Hasselt), 內介殼背面, $\times \frac{2}{3}$

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